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Army Aviation Maintainability Enhancement  
Analysis: A Field Survey of the AH-64  
Apache Attack Helicopter

David B. Durbin  
Richard N. Armstrong

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ARMY AVIATION MAINTAINABILITY ENHANCEMENT ANALYSIS:  
A FIELD SURVEY OF THE AH-64 APACHE ATTACK HELICOPTER

David B. Durbin  
Richard N. Armstrong

September 1996

APPROVED:



ROBIN L. KEESEE

Director, Human Research &  
Engineering Directorate

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U.S. ARMY RESEARCH LABORATORY

Aberdeen Proving Ground, Maryland



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## EXECUTIVE SUMMARY

"Tactics and strategy may win the battle, but logistics is what wins the war."

- General Colin Powell - 1991

Army aviation maintenance operations directly contribute to success on the battlefield by ensuring that aviation systems are mission ready and therefore capable of meeting the operational needs of the commander. Failure to maintain aviation systems in a timely manner removes assets from the hands of the user and can impact the outcome of the battle.

Aviation systems that are designed for quick, effective, and safe maintenance operations not only contribute to the battle but also reduce operation and sustainment costs. This is accomplished by minimizing manpower and training costs and by reducing the potential for maintainer injury and damage to equipment. Additionally, logistics resources such as tools, test equipment, and supply parts are used more effectively when aviation systems have been designed for effective maintainability.

An important step in the process of developing highly maintainable and cost-effective systems is the identification of maintainability shortfalls of fielded aviation systems. These shortfalls should address problems maintainers experience while performing maintenance on fielded systems and should result in lessons learned that can be applied to the development of future aviation systems as well as modifications of existing systems.

In support of the effort to identify maintainability shortfalls of fielded aviation systems, the U.S. Army Research Laboratory, Human Research and Engineering Directorate, Aviation Center Field Element, located at Fort Rucker, Alabama, conducted an extensive survey of 171 maintenance personnel who maintain the AH-64 Apache helicopter. The survey resulted in a set of lessons learned that can be applied to the development of future aircraft as well as modifications of existing aircraft to optimize maintainability and minimize costs. The lessons learned include improvements that could be made in the fault-detection location system, maintenance manuals, accessibility to components, design of fasteners and connectors, labels and markings on the aircraft, availability of supply parts and tools, safety and personnel protective gear (MOPP IV gear, cold weather clothing, and combat gear). The results of the survey have been reviewed by the Program Manager, Apache Attack Helicopter, TRADOC System Manager - Longbow and several Army aviation system acquisition agencies. Efforts have been initiated to evaluate and address the lessons learned. The results of the survey will also be used as a guide in the development of the RAH-66 Comanche to ensure that the mistakes made are not repeated in the development of this aircraft.

# ARMY AVIATION MAINTAINABILITY ENHANCEMENT ANALYSIS: A FIELD SURVEY OF THE AH-64 APACHE ATTACK HELICOPTER

## INTRODUCTION

### Effective Army Aviation Maintenance

#### Contribution to the Battle

Army aviation maintenance operations are vital in sustaining aviation operations. The maintenance needs of all aviation units must be met in an effective and timely manner to ensure success on the battlefield. Combat readiness requires the proper mix of equipment at the right place and at the right time. Failure to keep equipment operational has the same effect as combat losses: equipment is removed from the hands of the user and the outcome of the battle can be affected.

The combat mission and focus of aviation maintenance units are oriented to provide timely maintenance support for the aviation force. Aviation maintenance units and organizations are staffed predominantly by Aviation Branch personnel; they provide one-of-a-kind maintenance and support to aviation forces and organizations only. Maneuver force commanders can maximize combat potential if they understand that the aviation maintenance force is essential to the success of aviation operations.

#### Operation and Sustainment Cost Reduction

Systems that are designed for quick, effective, and safe maintenance operations not only increase the likelihood of battlefield success; they also help reduce operation and sustainment costs associated with aviation systems. Maintainability programs that address linkages between maintainability and its various operation and support costs (e.g., manpower, personnel, training) will field more cost-effective systems.

A significant way to ensure lower operation and sustainment costs is to improve the design of Army systems. System design is often the most important factor contributing to effective maintainability. Logistics resources such as tools and test equipment, facilities, technical manuals, and spare parts are used more effectively when the system has been designed for effective maintainability. Additionally, institutional and unit training requirements, maintainer staffing requirements and design of personnel equipment (e.g., tools, test equipment,

protective gear) can be optimized when the system has been designed for effective maintainability.

### Manpower and Personnel Integration (MANPRINT)

An important component of the effort to develop highly maintainable, cost-effective systems is the Army's manpower and personnel integration (MANPRINT) program. This program seeks to enhance the design of Army systems by addressing the skills, abilities, and performance limitations of personnel involved in the operation and maintenance of its systems. This is accomplished through careful integration of the seven domains of MANPRINT (manpower, personnel, training, human factors engineering, system safety, health hazards, and soldier survivability) into the acquisition process of Army systems to ensure that effective operation and maintenance are realized during fielding. One of the important steps in the MANPRINT process is the identification of maintainability shortfalls of fielded systems. The identification of these shortfalls can result in lessons learned for future system development or modifications of existing systems. It is important, therefore, that data that provide lessons learned for predecessor systems be applied during systems development and modification to ensure that cost-effective, maintainable systems are produced.

### AH-64 MAINTAINABILITY SURVEY

#### Purpose of Survey

In support of maximizing the contribution of aviation maintenance on the battlefield and reducing system operation and sustainment costs, the U.S. Army Research Laboratory, Human Research and Engineering Directorate (ARL HRED), Aviation Center Field Element (AVNC), located at Fort Rucker, Alabama, initiated an effort to identify maintainability lessons learned for the Army's force modernization aircraft. These lessons learned will help identify and quantify design, training, maintainer staffing, and personnel equipment shortfalls that can be eliminated or reduced to acceptable levels during system modifications and avoided during new systems development. Improving maintainability for the Army's force modernization aircraft will help minimize maintenance task times, maximize aircraft operational availability, enhance maintainer safety, and reduce overall operation and sustainment costs.

The initial step in identifying maintainability shortfalls was the development of a data collection instrument to be used to gather lessons learned information from maintenance personnel in field units. The survey was designed to be generic in content and format so that it

can be used to collect maintainability information about all Army aviation systems. Information collected can be used by program managers and the aviation systems acquisition community to identify, quantify, and resolve maintainability shortfalls with the goal of increasing the effectiveness of aviation maintenance on the battlefield and reducing operation and sustainment costs.

The AH-64 Apache attack helicopter was chosen as the first aircraft to be evaluated because its systems and missions encompass a wide range of aviation capabilities and functions. This provides an opportunity for the survey findings to be applied to the modification and development of other Army aviation systems including those that share identical components (e.g., engines, fasteners, avionics) and similar maintainability requirements (e.g., tool requirements, test equipment requirements) with the AH-64.

### Survey Development

The survey was developed based on field interviews with AH-64 maintenance personnel, a review of AH-64 maintenance test data (Durbin, 1994), technical manuals (Department of the Army, 1988, 1992, 1996), programs of instruction for maintenance personnel (U.S. Army Aviation Center, 1989a, 1989b, 1989c, 1992a, 1992b), maintenance design checklists, and maintenance process and design criteria as specified in system acquisition documents (Department of Defense, 1978, 1981, 1989a, 1989b). The format of the survey follows the general maintenance process undertaken by maintainers when performing unscheduled and scheduled maintenance on the AH-64. The format was designed in this manner to help the maintainer develop a mental model of the daily maintenance process he or she uses to aid in remembering specific information related to maintenance tasks. This assisted the maintainers in providing more detailed responses to survey items.

After initial development, the survey underwent a series of reviews by several Army agencies to ensure accuracy of content and format. Recommended changes provided by these agencies were incorporated into the survey. The survey was then administered to several AH-64 maintenance personnel as a pre-test to identify any problem areas with its content and format. Recommended changes provided by the AH-64 maintainers were then incorporated into the survey. As the final step in the validation of the maintainer survey, it was submitted to the Army Personnel Survey Program for review and approval. This program is administered by the Army Research Institute, Army Personnel Survey Office, in Alexandria, Virginia. All surveys that are to be administered to Army personnel are required to be submitted to this office for

approval. After review of the survey and incorporation of format changes recommended by the Army Research Institute, approval was granted and a survey control number assigned to the survey.

## Data Collection

The survey was administered to 171 maintenance personnel from several units located at Fort Hood, Texas, Fort Rucker, Alabama, Fort Eustis, Virginia, and the Arizona National Guard, Marana, Arizona. The units surveyed from Fort Hood included the 3-6 Cavalry Battalion, 1-4 Aviation Regiment, 1-227 Aviation Regiment and 2-158 Battalion. The units surveyed from Fort Rucker included the 2-229 Aviation Regiment, 1-212 Aviation Regiment, and personnel from various continental United States (CONUS) and OCONUS units attending the Noncommissioned Officers' Academy. The unit surveyed from Fort Eustis included personnel from the U.S. Army Aviation Logistics School. The unit surveyed from the Arizona National Guard was the 1-285 Aviation Regiment.

The maintenance personnel surveyed included the 67R - AH-64 Attack Helicopter Repairer, 68X - Armament-Electrical System Repairer, 68N - Avionics Mechanic, 68B - Aircraft Powerplant Repairer, and 68D - Aircraft Powertrain Repairer. These personnel maintain the AH-64 at the aviation unit maintenance (AVUM) level. The 68G - Aircraft Structural Repairer and 68H - Aircraft Pneudraulics Repairer are also designated to maintain the AH-64 at AVUM. These personnel were included in the survey pre-test but were not included in the final survey because the hands-on tasks they perform on the aircraft are very limited. The numbers of maintainers in each military occupational specialty (MOS) surveyed included 70 67R personnel, 46 68X personnel, 32 68N personnel, 15 68B personnel, and 8 68D personnel. The number of personnel surveyed in each MOS was based on the frequency with which they perform maintenance tasks on the aircraft. The 67R is the crew chief for the AH-64 and performs more maintenance tasks on the aircraft than any other MOS. The 68X is primarily dedicated to the AH-64 and performs more maintenance tasks on the aircraft other than the 67R. The 68N, 68B, and 68D perform maintenance tasks on several different Army aircraft including the AH-64. The 68N typically performs more maintenance tasks on the AH-64 at AVUM than do the 68B and 68D. The primary tasks and responsibilities of the maintenance personnel surveyed are listed in the section entitled AH-64 Maintenance Personnel Tasks and Responsibilities. Their demographic data (e.g., experience levels, work duties) are listed in the section entitled AH-64 Maintenance Personnel Demographic Data.



The survey was administered on site at the various Army installations. Typically, the maintainers reported to the maintenance hangar classroom, received a briefing from ARL personnel regarding the purpose of the survey, and then completed the survey. The maintainers were instructed to be very detailed in their responses regarding problems they experience maintaining the aircraft and recommendations for resolving the problems. Discussion was encouraged and lengthy dialogue often took place between ARL personnel and the maintainers in order to clarify issues and comments that were made. Additionally, hands-on evaluations of unit aircraft were made by ARL personnel to further clarify issues raised by the maintainers.

### Data Analysis

After the survey data were collected from the field, they were analyzed at the ARL HRED AVNC Field Element. The quantitative data, which included rating scale responses, yes and no responses, frequency responses, and personnel demographic information, were entered into a Microsoft Access 2.0 database for each MOS. An appropriate format structure was developed to input the data into the Access database. The format structure included data validation rules, default values, field size, and indexing parameters. This allowed for rapid entry and validation of the quantitative data.

After the data were entered into the Access database, they were then imported into a Microsoft Excel 5.0 spreadsheet for analysis and reduction. Formulas were developed in Excel and applied to the imported data sets. The formulas analyzed the quantitative data and provided descriptive statistical information. The analyzed data were then processed into graphical form using the graphing function residing in Excel 5.0. The graphs are illustrated in Appendix A.

Question narratives and comments provided by the maintainers were transcribed verbatim from the individual surveys onto comment data sheets for each MOS. The comments were assigned a unique identification code and entered into the Access database. The comment codes were then imported into the Excel spreadsheet for data analysis. This allowed similar comments to be grouped according to specific components or problem areas that they referenced. For instance, similar problems 68Xs experienced with the fault-detection location system (FDLS) were grouped together and listed under the appropriate question that asked about FDLS. Some comment groupings contain more than one comment provided by a single maintainer. Comments are contained in Appendix A and are essentially listed as they were written by the maintainers.

## AH-64 APACHE ATTACK HELICOPTER

The following section describes the major characteristics and systems of the AH-64 helicopter. The information contained in this section can be used as a reference when reviewing the survey results contained in Appendix A.

### General Description

The AH-64 Apache attack helicopter (see Figure 1) is a twin engine helicopter designed specifically for the attack helicopter role. The helicopter accommodates an aircrew of two in a tandem configuration and delivers various combinations of ordnance while providing helicopter survivability and aircrew protection.

Helicopter survivability is achieved by providing redundant systems and components, flight maneuverability and agility, critical components ballistic resistance, high impact survivability, reduced detectability, and wire strike protection.

The wings provide mounting surfaces for four external pylons which can carry external fuel tanks, Hellfire missiles, 2.75-inch folding fin aerial rocket (FFAR) launchers, or a symmetrically loaded combination of any two weapon racks.

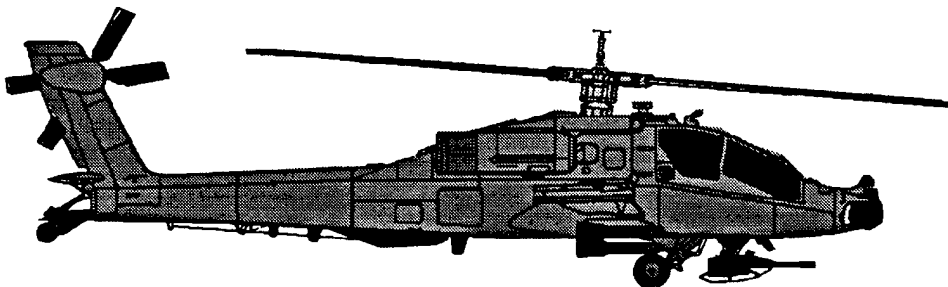


Figure 1. AH-64 Apache attack helicopter.

A turret-mounted 30-mm chain gun, under the forward fuselage, can fire as many as 625 rounds per minute.

The helicopter is powered by two T700-GE-701 or T700-GE-701C engines, which drive the main rotor through individual engine, nose-mounted gearboxes, and a main transmission. The

main transmission power take-off shaft drives the tail rotor through intermediate and tail rotor gearboxes.

The auxiliary power unit (APU) drives the accessory drive section of the main transmission to provide full electrical, pneumatic, and hydraulic power to the helicopter when the main engines are not on line. The APU is also used to provide pressurized air system (PAS) air to start the main engines.

The flight controls are mechanically actuated, hydraulically powered, and electrically assisted in all flight control axes.

A curved canopy structure provides integral roll-over protection. The canopy has a blast shield between the two crew stations. Each crew station contains an adjustable armored seat. The seats incorporate armored wings that pivot to facilitate entrance to and exit from the crew stations.

## Systems Description

The AH-64 is composed of several specific systems. The following is a description of these systems:

### Airframe

The airframe is a one-piece integral design. It provides mounting points for the helicopter systems and components. The wings mount two external pylons per wing, which provide external stores stations.

### Landing Gear System

The landing gear system supports the helicopter during ground operations and enhances survivability during high impact landings. The helicopter has a conventional landing gear system with two main wheel assemblies and a tail wheel assembly.

### Fuel System

The fuel system stores and distributes fuel to the engines and APU. The fuel cells are crashworthy with a self-sealing capability and are located fore and aft of the ammunition bay. To prevent fuel cell combustion in the two main fuel cells, a nitrogen-inserting unit (NIU)

replaces expended fuel with nitrogen. Auxiliary fuel tanks (extended range kit) can be mounted one per pylon on the wings.

### Auxiliary Power Unit

APU drives the main transmission accessory drive section to provide pneumatic, hydraulic, and electrical power during main engine start and maintenance operations. The APU makes the helicopter self supporting in a field environment by eliminating the need for aviation ground power units. The APU also supplies pressurized air to the environmental control system, fuel transfer system, fuel boost system, and utility and external air receptacles during ground operations when engines are not on line.

### Engine System

The engine system drives the main transmission. The engine system consists of two T700-GE-701 or T700-GE-701C front drive turboshaft engines. The engines drive the main transmission through individual engine nose-mounted gearboxes.

### Drive System

The drive system driveshafts and gearboxes transmit engine power to the main rotor, tail rotor, and accessories. The gearboxes provide a change of drive angle and reduction in revolutions per minute (rpm). The engine nose-mounted gearboxes drive the main transmission. The main transmission drives the main rotor and the intermediate and tail gearboxes. The intermediate and tail gearboxes drive the tail rotor assembly.

### Rotor System

The rotor system is comprised of a four-bladed main rotor and a tail rotor assembly. The main rotor provides lift and thrust. The tail rotor provides yaw and anti-torque to stabilize the aircraft in its direction of flight.

### Electrical System

The electrical system provides all electrical power requirements of the helicopter, distributes the power, and provides circuit protection. The electrical system consists of the main AC and DC systems and an emergency DC system.

### Hydraulic System

The hydraulic system provides power to the flight controls, APU start motor, and

hydraulically operated auxiliary equipment. The hydraulic system consists of two independent closed loop systems and an emergency system.

#### Flight Controls System

The flight controls system provides control of the helicopter during all flight maneuvers. The flight controls are mechanically actuated, hydraulically powered, and electrically assisted for vertical, longitudinal, lateral, and directional flight control.

#### Pressurized Air System (PAS)

PAS filters, pressures, regulates, and distributes air to the AH-64 pneumatically dependent systems and components.

#### Environmental Control System (ECS)

ECS provides conditioned or outside air to the crew stations for crew comfort. The ECS also provides cooling air to electrical components in the forward avionics bays.

#### Multiplex (MUX) Data Bus System

MUX is a general purpose electronic information transfer system that provides a flexible interface between components and fault-detection location system (FDLS) signal routing for processing information critical to helicopter survival.

#### Fault-Detection Location System (FDLS)

FDLS provides the AH-64 multiplex system with an onboard test of the status of all mission-essential line-replaceable units to determine if they are functioning correctly. The FDLS software resides in the flight control computer (FCC).

#### Instrument Systems

Instruments are grouped into four functional areas:

##### Engine

The engine instruments provide system status and operation monitoring.

##### Flight

The flight instruments provide attitude, altitude, and air speed information.

## Navigation

The navigation instruments provide position reference and fixing to permit day, night, and instrument meteorological condition (IMC) flight operations.

## Miscellaneous

Miscellaneous instruments provide additional information about icing, g-force, hydraulic, fuel quantity, and rotor.

## Avionics Systems

Avionics provides the AH-64 crew with communication, navigation, and identification aids, heading and altitude reference, automatic stabilization, and survivability aids.

### Digital Automatic Stabilization Equipment (DASE) System

DASE provides helicopter hover and flight stabilization to establish a stable weapons platform while decreasing the pilot's workload.

### Active and Passive Aircrew Survivability Equipment (ASE)

ASE includes the following systems:

#### Radar warning and jamming

The radar warning and jamming equipment detects enemy radar and provides automatic countermeasures against land based or airborne radar systems.

#### Infrared (IR) jamming

The IR jamming equipment provides automatic countermeasures against IR-seeking missiles.

#### Wire strike protection

The wire strike protection equipment protects the helicopter from damage caused by striking power lines and other wires during nap-of-the-earth (NOE) operations.

#### Chaff and flare

The chaff and flare equipment provides countermeasures to decoy radar-guided weapons away from the aircraft.

## Air Data Subsystem (ADSS)

ADSS provides air data information for DASE functions, LDNS operation, fire control solution, and FDLS.

## Armament Systems

The armament system provides quick response helicopter weapon systems selection, programming, and firing for close, medium, and long-range targets. The armament includes the 30-mm chain gun, point target weapon system (Hellfire missile), aerial rocket Hydra 70, and external stores.

## Sighting and Display System

The sighting and display system includes the target acquisition designation sight (TADS) and pilot night vision sensor (PNVS) assemblies, video recorder, and internal boresight. TADS provides a means for the copilot-gunner (CPG) to scan the landscape to locate, track, range and designate targets. PNVS provides a means for the pilot to fly NOE and enhances navigation at night or in adverse weather.

## Utility System

The utility system includes the following systems:

### Windshield Wipers

The windshield wipers remove moisture from the windshield.

### Anti-Ice and De-Ice

Anti-ice and de-ice provide heat to remove ice to maintain visibility, engine operation, rotor performance, and air data sensing.

### Defog

Defog provides canopy defogging.

### Fire Detection and Extinguishing

Fire detection and extinguishing provide for the detection and extinguishing of fires in the engines, APU, and shaft-driven compressor (SDC).

## Canopy Jettison

The canopy jettison provides a means of jettisoning the canopy.

## Exterior Lighting System

The exterior lighting system is composed of the landing and searchlight, navigational light, anti-collision lights, and formation lights. The exterior lighting provides omnidirectional landing and search visibility during low visibility conditions, navigational and formation position during flight, and anti-collision warning during takeoff and landing.

## ARMY AVIATION MAINTENANCE STRUCTURE

Army aviation maintenance activities are organized to provide the battlefield commander with the maximum number of safe, mission-capable aircraft. These activities must be dedicated to fast, continuous, and reliable aviation maintenance support in the highly mobile, integrated battlefield. Following is a description of the three levels of aviation maintenance activities organized to provide the commander with a constant supply of mission-ready aircraft:

### Aviation Unit Maintenance (AVUM)

Each aviation unit is responsible for performing maintenance on its assigned aircraft. AVUM provides quick turnaround through repair by replacement, minor repairs, adjustments, cleaning, lubricating, and servicing. It provides mobile responsive support through maintenance support teams. The general concept is for crew chiefs assigned to specific aircraft to perform daily servicing, daily inspections, and high frequency remove-and-replace-type aircraft repairs. Scheduled maintenance (other than daily inspections) and the more time-consuming repairs are normally performed by an AVUM maintenance element within the organization.

### Aviation Intermediate Maintenance (AVIM)

Aviation maintenance battalion AVIM units provide support maintenance for AVUM units and are located in the division, corps, and echelons above corps (EAC). They perform extensive repair of aviation systems using specific tools and test equipment not available at AVUM. In terms of maintenance responsibility, AVIM units serve as the bridge between units owning and operating aircraft and overhaul depots located away from the battlefield. The goal of AVIM units in combat is the same as that of AVUM units: to provide the battlefield commander



with the maximum number of safe, fully mission-capable aircraft. Divisional, corps, and EAC AVIM units essentially perform the same type of support functions.

#### Aviation Depot Maintenance

Depot maintenance operations support both combat forces and the overall DA inventory management program. They perform extensive repairs (including major overhauls) on aviation systems. To support combat forces, depot maintenance operations provide backup to AVIM and assist the forces with technical training during mobilization and peacetime. To support the overall DA inventory management program, depot maintenance operations serve as a source of combat-ready materiel.

#### AH-64 MAINTENANCE PERSONNEL TASKS AND RESPONSIBILITIES

Following are the primary tasks and responsibilities (Department of the Army, 1994) of the maintenance personnel, by skill level, who completed the survey.

#### 67R - AH-64 Attack Helicopter Repairer

##### Major Duties

The AH-64 attack helicopter repairer supervises and performs maintenance on AH-64 attack helicopters, excluding repair of systems components. Duties for MOS 67R at each level of skill are

##### MOS 67R10

Removes and installs aircraft subsystem assemblies such as engines, rotors, gearboxes, transmissions mechanical flight controls and their components. Services and lubricates aircraft and subsystems. Prepares aircraft for inspections and maintenance checks. Performs scheduled inspections and assists in performing special inspections. Performs limited maintenance operational checks and assists in diagnosing and troubleshooting aircraft subsystems using special tools and equipment as required. Uses and performs operator maintenance on tools, special tools, and aircraft ground support equipment. Prepares forms and records related to aircraft maintenance. Performs air crew member duties as required.

## MOS 67R20

Performs duties described in the previous paragraph and provides technical guidance to subordinate personnel. Performs operational checks and scheduled inspections. Diagnoses and troubleshoots malfunctions in aircraft subsystems.

## MOS 67R30

Supervises and provides technical guidance to subordinate soldiers performing aircraft and subsystem maintenance and evaluates the technical training program. Evaluates maintenance operations and facilities for compliance with directives, technical manuals, work standards, safety procedures, and operational policies. Performs maintenance trend analysis and applies production control, quality control, and other maintenance management principles and procedures to airplane maintenance operations. Plans, conducts, and supervises aircraft technical inspections. Computes basic weight balance records. Participates in maintenance test flights. Ensures compliance with aircraft configuration control, Army oil analysis program, and test-measuring diagnostic calibration.

## MOS 67R40

Supervises aircraft maintenance and technical inspection activities. Determines man-hours, personnel, parts, and facility requirements to repair aircraft and associated equipment. Plans aircraft maintenance areas, component repair shops, and facilities. Instructs subordinates in aircraft repair and technical inspection techniques and procedures according to directives, technical manuals, work standards, and operational policies. Maintains supply economy and discipline. Supervises the technical training program. Prepares evaluations, special reports, and records pertaining to aircraft maintenance repair and related activities. Recommends and administers plans and policies.

## 68X - Armament-Electrical System Repairer

### Major Duties

The AH-64 armament and electrical system repairer performs AVUM, AVIM, and depot maintenance on the AH-64 electrical and instrument systems and the electrical, electronic, mechanical, and pneudraulic systems associated with the AH-64 armament and missile and fire control system. Other major duties for MOS 68X at each level of skill are

## MOS 68X10

Diagnoses and repairs malfunctions in AH-64 armament, electrical, instrument, and fire control systems and components, including solid state and transistorized subsystems according to technical manuals, directives, and safety procedures. Performs maintenance, authorized modifications, and alignment on AH-64 weapons components, fire control units, sighting elements, electronic and mechanical devices, and instruments. Performs operational checks, ammunition loading and unloading, and weapon subsystems configuration changes for all AH-64 fire control systems. Tests, troubleshoots, and repairs test sets and diagnostic equipment. Requisitions and maintains shop and bench stock for repair of AH-64 armament, electrical, instrument, and fire control systems. Maintains facilities for storage of weapons, ammunitions, and weapons-cleaning equipment and supplies. Uses and performs operator maintenance on common and special tools. Maintains records on weapons and subsystems. Prepares forms and records related to MOS.

## MOS 68X20

Performs duties described in paragraph 68X10 and provides technical guidance to subordinate soldiers. Participates in maintenance test flights as required.

## MOS 68X30

Supervises and provides technical guidance to subordinate soldiers performing AH-64 armament, electrical, instrument or fire control systems maintenance. Evaluates maintenance operations and facilities for compliance with directives, technical manuals, work standards, safety procedures, and operational policies. Performs maintenance trend analysis and applies production control, quality control, and other maintenance management principles and procedures to AH-64 armament, electrical, instrument, or fire control systems maintenance and shop operations. Supervises the establishment of the forward area rearming point (FARP). Instructs personnel and conducts technical training in AH-64 armament, electrical, instrument, or fire control systems maintenance, supply, and safety techniques. Evaluates the technical training program. Monitors requisition of parts, tools, and supplies.

## MOS 68X40

Supervises AH-64 armament, electrical, instrument and fire control systems maintenance and technical inspection activities. Determines man-hours, personnel, parts and facility requirements to repair AH-64 armament, electrical, instrument, fire control systems and associated equipment. Plans aircraft maintenance areas, repair shops and facilities. Instructs

subordinates in AH-64 armament, electrical, instrument, and fire control systems repair and technical inspection techniques and procedures, according to directives, technical manuals, work standards, and operational policies. Maintains supply economy and discipline. Supervises the armament electrical, instrument, and fire control systems technical training program. Prepares evaluations, special reports, and records pertaining to AH-64 armament, electrical, instrument, and fire control systems maintenance and related activities. Recommends and administers plans and policies.

## 68N Avionics Mechanic

### Major Duties

The avionics mechanic performs unit level maintenance on tactical communications security (COMSEC), communication, navigation, identification friend or foe (IFF), and flight control equipment. Duties for MOS 68N at each level of skill are

#### MOS 68N10

Repairs, replaces, and performs operational and preventive checks and alignments on aircraft flight control, stabilization systems, avionics and controlled cryptographic equipment. Troubleshoots equipment and traces avionic and cryptographic equipment wiring harnesses using technical manuals and schematic drawings to diagnose and isolate faults and make repairs. Performs unit maintenance on special and common hand tools and test, measurement, and diagnostic equipment (TMDE). Requisitions and maintains shop and bench stock for repair of aircraft avionics equipment. Prepares forms and records related to aircraft maintenance.

#### MOS 68N20

Performs duties described in the previous paragraph and provides technical guidance to subordinate personnel. Schedules maintenance on test, measurement, and diagnostic equipment. Alters or modifies material according to DA-approved modification work orders.

#### MOS 68N30

Supervises and provides technical guidance to subordinate personnel performing maintenance of aircraft, avionic, COMSEC, flight control, and stabilization equipment. Evaluates maintenance operations and facilities for compliance with directives, technical manuals, work standards, safety procedures, and operational policies. Performs maintenance trend analysis and applies production control, quality control, and other maintenance management principles and

procedures to avionic repair shop operations. Instructs personnel and conducts technical training in aircraft avionic, COMSEC, flight control, and stabilization equipment maintenance. supply, and safety techniques. Evaluates the technical training program. Monitors requisition of parts, tools and supplies.

## 68B Aircraft Power Plant Repairer

### Major Duties

The aircraft power plant repairer supervises, inspects, and performs AVUM, AVIM, and depot maintenance on aircraft turbine engines and components. Duties for MOS 68B at each level of skill are

### MOS 68B10

Removes replaces, services, prepares, preserves, cleans and stores engine assemblies or components. Disassembles, repairs, reassembles, adjusts, diagnostically tests turbine engine systems, subsystems, and components according to directives. Assists in troubleshooting engines and rigging engine controls. Performs limited maintenance operational checks. Uses and performs user maintenance on common and special tools. Requisitions and maintains shop and bench stock for repair of aircraft engines. Prepares request for turn-ins and repair parts and engine components. Prepares forms and records related to MOS.

### MOS 68B20

Performs duties described in the previous paragraph and provides technical guidance to subordinate personnel. Diagnoses and troubleshoots malfunctions in aircraft engines and their components. Participates in maintenance test flights as required.

### MOS 68B30

Supervises and provides technical guidance to subordinate personnel performing aircraft power plant maintenance. Evaluates maintenance operations and facilities for compliance with directives, technical manuals, work standards, safety procedures, and operational policies. Performs maintenance trend analysis and applies production control, quality control, and other maintenance management principles and procedures to aircraft engine maintenance and shop operations. Instructs personnel and conducts technical training in aircraft engine system maintenance, supply and safety techniques. Evaluates the technical training program. Monitors requisition of parts, tools, and supplies.

## 68D Aircraft Power Train Repairer

### Major Duties

The aircraft power train repairer supervises, inspects, and performs AVUM, AVIM, and depot maintenance on aircraft power train systems. Duties for MOS 68D at each level of skill are

#### MOS 68D10

Removes and replaces power train quills, transmissions adapting parts, rotor hub and tanks. Disassembles friction dampers and hanger assemblies. Disassembles, repairs, reassembles, adjusts, balances, and aligns power train components. Performs nondestructive inspections on aircraft components and related items. Uses and performs operator maintenance on ground support equipment, common and special tools. Maintains facilities for storage of flammable and hazardous materials. Requisitions and maintains shop and bench stock for repair of aircraft power train systems and subsystems. Prepares requests for turn-ins and repair parts for power train components. Prepares forms and records related to aircraft maintenance.

#### MOS 68D20

Performs duties described in the previous paragraph and provides technical guidance to subordinate personnel. Diagnoses and troubleshoots malfunctions in aircraft power train components and their subcomponents. Participates in maintenance test flights as required.

#### MOS 68D30

Supervises and provides technical guidance to subordinate personnel performing aircraft power train system maintenance and nondestructive inspection. Evaluates maintenance operations and facilities for compliance with directives, technical manuals, work standards, safety procedures, and operational policies. Performs maintenance trend analysis and applies production control, quality control, and other maintenance management principles and procedures to aircraft power train system maintenance, nondestructive inspection and shop operations. Instructs personnel and conducts technical training in aircraft power train system maintenance, nondestructive inspection, supply and safety techniques. Evaluates the technical training program. Monitors requisition of parts, tools, supplies.

## AH-64 MAINTENANCE PERSONNEL DEMOGRAPHIC DATA

Following are the demographic data for maintenance personnel who completed the AH-64 maintenance survey. These data provide experience level, anthropometric and work duty information as reported by the maintainers. This information helps define the population characteristics of the personnel who completed the survey.

### 67R - AH-64 Attack Helicopter Repairer

Total Personnel Surveyed: 70

Rank:

SFC	- 6 personnel
SSG	- 8 personnel
SGT	- 16 personnel
CPL	- 3 personnel
PFC	- 6 personnel
SPC	- 30 personnel
No rank given:	- 1 personnel

Military Occupational Specialty (MOS):

67R	- 6 personnel
67R10	- 31 personnel
67R20	- 16 personnel
67RQ2	- 1 personnel
67R30	- 5 personnel
67R30A2	- 1 personnel
67R30F	- 2 personnel
67R3FQ2	- 1 personnel
67R40	- 2 personnel
67R4FA2Q2	- 1 personnel
67Z50	- 1 personnel
67R-67K	- 1 personnel
67R-67Z	- 1 personnel
No MOS given:	- 1 personnel

How long 67R personnel have served in their MOS:

Average	- 3.6 years
High	- 8 years
Low	- 1 month

How long 67R personnel have served in Army aviation maintenance:

Average	-	6.6 years
High	-	23 years
Low	-	1 month

Other MOSs 67R maintainers have been in\*:

67Y	- 15 personnel
67V	- 9 personnel
67N	- 7 personnel
67G	- 2 personnel
68J	- 2 personnel
11B	- 1 personnel
11C	- 1 personnel
12B	- 1 personnel
13B	- 1 personnel
13N	- 1 personnel
19D	- 1 personnel
24G	- 1 personnel
31C	- 1 personnel
62J	- 1 personnel
63B	- 1 personnel
63E	- 1 personnel
65E	- 1 personnel
67M	- 1 personnel
67T	- 1 personnel
67U	- 1 personnel
67W	- 1 personnel
68F	- 1 personnel
68G	- 1 personnel
68M	- 1 personnel
92A	- 1 personnel

\*Several maintainers have been in more than one other MOS.

Other Army aircraft 67R personnel have worked on\*:

OH-58	- 27 personnel
AH-1	- 25 personnel
UH-1	- 19 personnel
UH-60	- 16 personnel
OH-6	- 5 personnel
CH-47	- 1 personnel
MH-60	- 1 personnel



OH-13	- 1 personnel
U-8	- 1 personnel
U-21	- 1 personnel

\*Several personnel have worked on more than one other Army aircraft.

Height:

Average	-	69.7 inches
High	-	77.0 inches
Low	-	60.0 inches

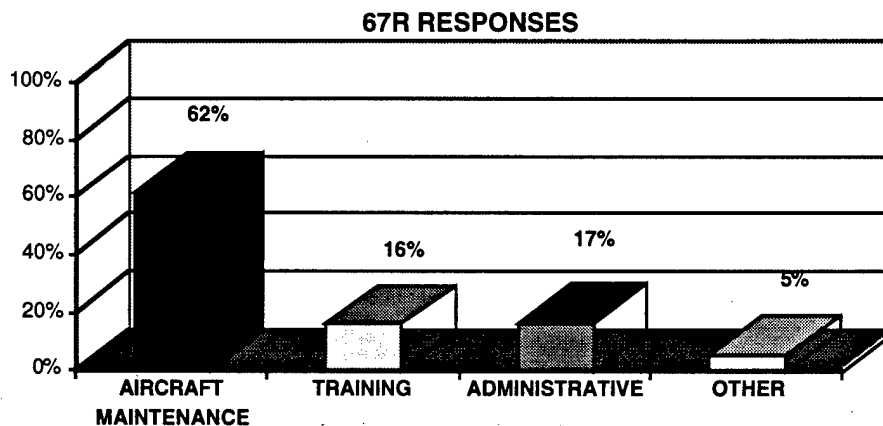
Weight:

Average	-	177 lb
High	-	235 lb
Low	-	122 lb

Age:

Average	-	28.2 years
High	-	48 years
Low	-	19 years

67R personnel reported that they typically spend the following time each day in Aircraft Maintenance activities, Training (Non-administrative) activities, Administrative (Non-maintenance) activities, and Other activities:



Other activities:

Work on details in between duties	-	4 personnel
Field duty	-	3 personnel

Crash rescue	-	2 personnel
PMCS	-	2 personnel
Waiting for parts	-	2 personnel
Vehicle maintenance support	-	2 personnel
Safety NCO	-	1 personnel
Infantry work	-	1 personnel
Quality control	-	1 personnel
Cleaning hangar	-	1 personnel
PSG maintenance	-	1 personnel
METL related tasks	-	1 personnel
Appointments	-	1 personnel
Cleaning camouflage	-	1 personnel
Cleaning tents	-	1 personnel
Stacking tents in conex	-	1 personnel

#### 68X - Armament - Electrical System Repairer

Total Personnel Surveyed: 46

Rank:

SFC	-	1 personnel
SSG	-	4 personnel
SGT	-	11 personnel
CPL	-	3 personnel
SFC	-	26 personnel
PV2	-	1 personnel

Military Occupational Specialty (MOS):

68X	-	15 personnel
68X10	-	19 personnel
68X20	-	4 personnel
68X20P	-	2 personnel
68X30	-	3 personnel
68X30(4)	-	1 personnel
68X3P	-	1 personnel
68X40A2	-	1 personnel

How long 68X personnel have served in their MOS:

Average	-	4 years
High	-	14 years
Low	-	1 month

How long 68X personnel have served in Army maintenance:

Average	-	5 years
High	-	17 years
Low	-	1 year

Other MOSs 68X maintainers have been in:

68J	-	15 personnel
11B	-	1 personnel
12B	-	1 personnel
29V	-	1 personnel
52D	-	1 personnel
63B	-	1 personnel
68K	-	1 personnel

Other Army aircraft maintainers have worked on\*:

AH-1	-	22 personnel
UH-60	-	12 personnel
OH-58	-	11 personnel
OH-58C	-	4 personnel
UH-1	-	3 personnel
OH-58D	-	2 personnel
OH-58A	-	1 personnel

\*Several personnel have worked on more than one other Army aircraft.

Height:

Average	-	70.3 inches
High	-	78.0 inches
Low	-	63.0 inches

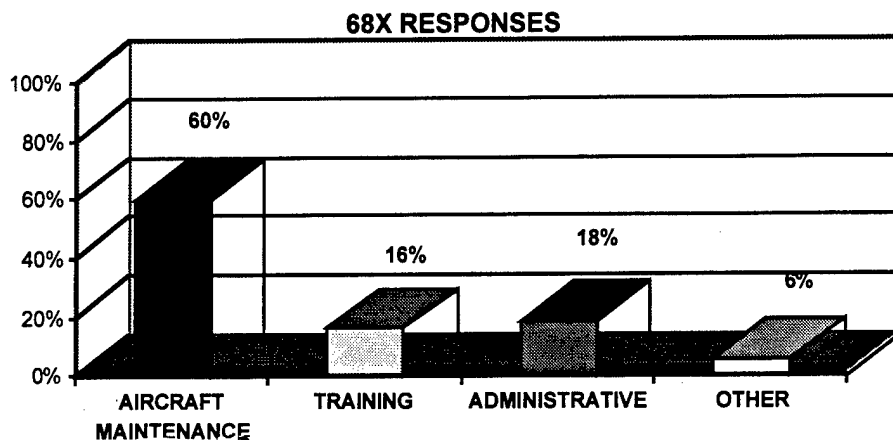
Weight:

Average	-	178 lb
High	-	290 lb
Low	-	122 lb

Age:

Average	-	26 years
High	-	48 years
Low	-	20 years

68X personnel reported that they typically spend the following time each day in Aircraft Maintenance activities, Training (Non-administrative) activities, Administrative (Non-maintenance) activities, and Other activities:



Other Activities:

Duty	-	6 personnel
Fall and spring cleanup (picking up trash)	-	5 personnel
Motor pool (working on trucks)	-	4 personnel
CQ duty	-	2 personnel
EPA detail	-	2 personnel
Shop duties	-	2 personnel
Standing in parades	-	1 personnel
Driving trucks	-	1 personnel
Field duty - recovery	-	1 personnel
Cammo	-	1 personnel
Inventories	-	1 personnel
Post duties	-	1 personnel

**68N - Avionics Mechanic**

Total Personnel Surveyed: 32

Rank:

SFC	-	1 personnel
SSG	-	5 personnel
SGT	-	12 personnel
CPL	-	1 personnel
SPC	-	9 personnel

PFC - 2 personnel  
PV2 - 1 personnel  
No Rank Given: 1 personnel

Military Occupational Specialty (MOS):

68N - 13 personnel  
68N10 - 6 personnel  
68N10W6 - 1 personnel  
68N10X1W6 - 1 personnel  
68NX1W6 - 3 personnel  
68N20 - 1 personnel  
68N20W6 - 2 personnel  
68N20W5W6 - 1 personnel  
68N30 - 1 personnel  
68N31 - 1 personnel  
68N30X1W6 - 1 personnel  
68N30X1W6W5 - 1 personnel

How long 68N personnel have served in their MOS:

Average - 6.1 years  
High - 20 years  
Low - 1 month

How long 68N personnel have served in Army aviation maintenance:

Average - 6.3 years  
High - 20 years  
Low - 1 month

Other MOSs 68N maintainers have been in:

11B - 1 personnel  
31U - 1 personnel  
32H - 1 personnel  
35M - 1 personnel  
35P - 1 personnel  
55B - 1 personnel  
67N - 1 personnel  
68F - 1 personnel  
68R - 1 personnel  
91B - 1 personnel

Other Army aircraft 68N maintainers work on:

UH-60	-	25 personnel
OH-58	-	17 personnel
UH-1	-	15 personnel
AH-1	-	10 personnel
OH-58C	-	10 personnel
OH-58A	-	9 personnel
OH-58D	-	7 personnel
CH-47	-	6 personnel
U-21	-	3 personnel
EH-60	-	2 personnel
OH-6	-	2 personnel
OV-1	-	2 personnel
C-12	-	1 personnel
U-8	-	1 personnel

\* Personnel work on more than one aircraft.

Height:

Average	-	68.9 inches
High	-	78.0 inches
Low	-	53.0 inches

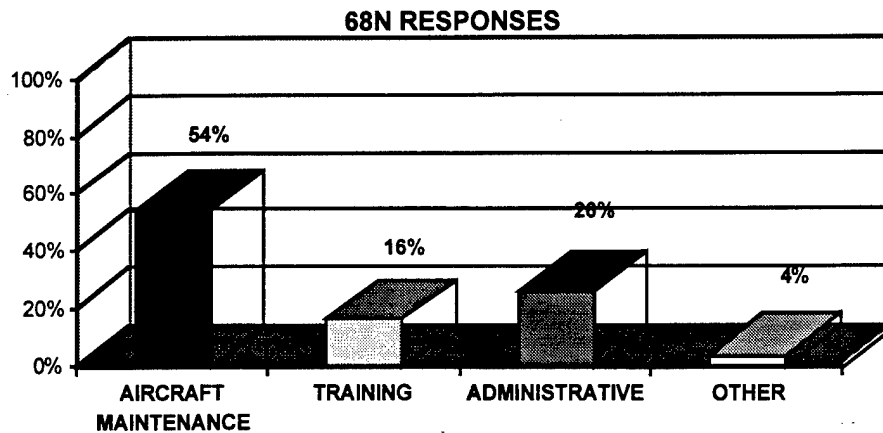
Weight:

Average	-	169 lb
High	-	230 lb
Low	-	127 lb

Age:

Average	-	27.3 years
High	-	41 years
Low	-	19 years

68N personnel reported that they typically spend the following time each day in Aircraft Maintenance activities, Training (Non-administrative) activities, Administrative (Non-maintenance) activities, and Other activities:



Other Activities:

Details (cleanup)	- 3 personnel
Duty	- 3 personnel
Motor pool	- 2 personnel

**68B - Aircraft Power Plant Repairer**

Total Personnel Surveyed: 15

Rank:

SSG	- 4 personnel
SGT	- 3 personnel
SPC	- 6 personnel
PFC	- 1 personnel
PV2	- 1 personnel

Military Occupational Specialty (MOS):

68B	- 2 personnel
68B10	- 7 personnel
68B20	- 3 personnel
68B30	- 3 personnel

How long 68B personnel have served in their MOS:

Average	- 7.3 years
High	- 17 years
Low	- 3 months

How long 68B personnel have served in Army aviation maintenance:

Average	-	7.3 years
High	-	17 years
Low	-	3 months

Other MOSs 68B maintainers have been in:

67N	-	2 personnel
13N	-	1 personnel
67T	-	1 personnel
95B	-	1 personnel

Other Army aircraft 68B maintainers work on:\*

UH-1	-	8 personnel
UH-60	-	8 personnel
AH-1	-	8 personnel
OH-58	-	8 personnel
CH-47	-	5 personnel
OV-1	-	3 personnel
OH-58A	-	2 personnel
OH-58C	-	2 personnel
OH-58D	-	2 personnel
EH-60	-	1 personnel
UH-21	-	1 personnel

\*Personnel work on more than one aircraft.

Height:

Average	-	69.5 inches
High	-	73 inches
Low	-	65 inches

Weight:

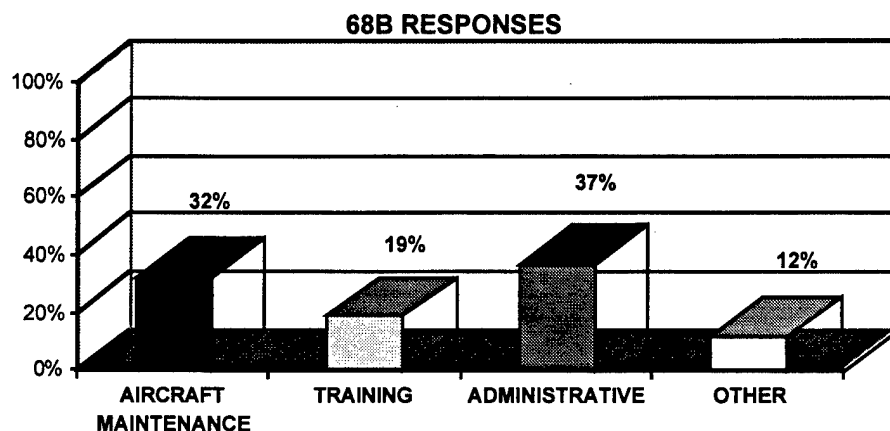
Average	-	185 lb
High	-	220 lb
Low	-	130 lb

Age:

Average	-	27 years
High	-	38 years
Low	-	20 years



68B personnel reported that they typically spend the following time each day in Aircraft Maintenance activities, Training (Non-administrative) activities, Administrative (Non-maintenance) activities, and Other activities:



Other Activities:

Aircraft work out of MOS	-	1 personnel
Tool operations	-	1 personnel
Vehicle maintenance	-	1 personnel
Unit supply operations	-	1 personnel
Maintenance on ground support equipment	-	1 personnel

**68D - Aircraft Power Train Repairer**

Total Personnel Surveyed: 8

Rank:

SGT	-	3 personnel
SPC	-	4 personnel
PFC	-	1 personnel

Military Occupational Specialty (MOS):

68D	-	3 personnel
68D10	-	2 personnel
68D20	-	3 personnel

How long 68D personnel have served in their MOS:

Average	-	4 years
High	-	9 years
Low	-	3 months

How long 68D personnel have served in Army aviation maintenance:

Average	-	4.5 years
High	-	11 years
Low	-	3 months

Other MOSs 68D maintainers have been in:

19K	-	1 personnel
63N	-	1 personnel
67V	-	1 personnel

Other Army aircraft 68D maintainers worked on\*:

UH-60	-	7 personnel
AH-1	-	4 personnel
UH-1	-	4 personnel
OH-58	-	4 personnel
OH-58C	-	2 personnel
CH-47	-	2 personnel
OV-1	-	1 personnel
OH-58D	-	1 personnel

\*Personnel work on more than one aircraft.

Height:

Average	-	71 inches
High	-	78 inches
Low	-	65 inches

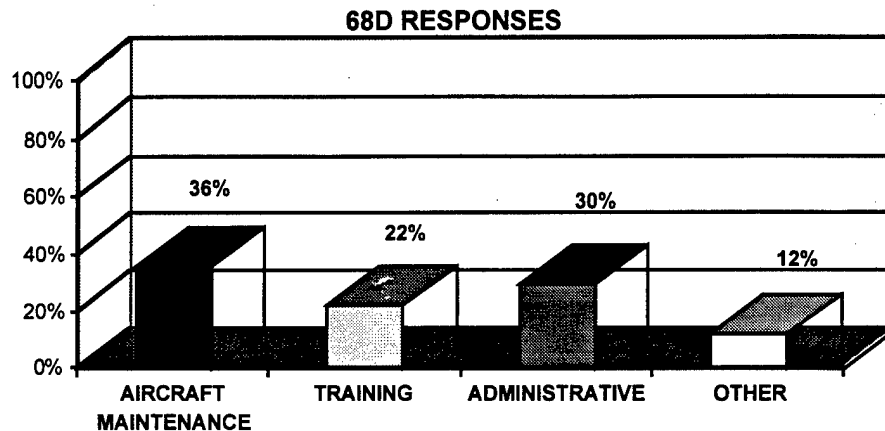
Weight:

Average	-	167 lb
High	-	200 lb
Low	-	145 lb

Age:

Average	-	27.3 years
High	-	35 years
Low	-	20 years

68D personnel reported that they typically spend the following time each day in Aircraft Maintenance activities, Training (Non-administrative) activities, Administrative (Non-maintenance) activities, and Other activities:



Other Activities:

Motor pool	-	1 personnel
Details	-	1 personnel
PT	-	1 personnel
Formations	-	1 personnel
Training	-	1 personnel
Inspections	-	1 personnel
NCO retention duties	-	1 personnel
Finding tools and parts	-	1 personnel
Ground equipment maintenance	-	1 personnel
PMCS	-	1 personnel
Ranges	-	1 personnel
Property accountability	-	1 personnel
CTT training	-	1 personnel
Safety briefings	-	1 personnel
Cleaning	-	1 personnel

## SUMMARY OF AH-64 MAINTAINABILITY SURVEY RESULTS

The following is a summary of the significant survey responses reported by AH-64 maintenance personnel. A general overview of the maintainer responses is provided with examples of components and equipment that personnel reported they have difficulty maintaining. The responses are then summarized as lessons learned followed by a discussion of the impact they have on maintainability of the aircraft. Remember that the survey results are based on

maintainer experience and therefore contain subjective information. Efforts to further quantify maintainer responses need to be conducted. This includes performing trade-off analyses to determine the feasibility of changes in design, training, or maintenance procedures.

The summary information contained in this section as well as the complete survey results contained in Appendix A will provide the Program Manager, Apache attack helicopter, and the aviation systems acquisition community a set of lessons learned that can be applied to modifications of the AH-64 and AH-64D. The Program Manager, Apache attack helicopter, is already addressing several of the survey findings. These include replacement of the FDLS with a more accurate built-in test system, hosting of paper technical manuals on laptop personal computers, general accessibility improvements, and increased use of captive fasteners. The survey findings, in general, should be fully addressed by the AH-64 system improvement efforts being conducted by the program manager and aviation systems acquisition community including the Operation and Support Cost Process Action Team and the Apache Readiness Improvement Program (ARIP).

These survey findings will also provide lessons learned to the Program Manager, RAH-66 Comanche and the aviation systems acquisition community to ensure the problems reported herein are not repeated during the development of the RAH-66. This information can also be used by program managers of other Army aviation systems that share identical components with the AH-64 (e.g., engines, fasteners, avionics) or similar maintainability requirements (e.g., tool requirements, test equipment requirements) to help identify and resolve maintainability problems associated with those aircraft.

## General Overview

### Troubleshooting

When asked about problems they experience while troubleshooting faults on the aircraft, maintainers reported that the FDLS is not always reliable and troubleshooting manuals are often vague, do not fully address problems they experience in the field, and are sometimes inaccurate.

### Accessibility

When asked about problems they experience while accessing components on the

aircraft, maintainers reported that there is a lack of an adequate number of access panels in specific areas on the aircraft (e.g., crew station compartment, left and right 60 panels, APR-39 compartment), access panels are too small (e.g., horizontal stabilator bolts access panel); access panels are not easy to open and remove (e.g., tail rotor gearbox panel, left and right 90 panels); there is interference from surrounding components when accessing certain other components (e.g., interference from the ECU, TADS-PNVs, air data processor); lack of sufficient work space in certain areas of the aircraft (e.g., ECU compartment, 30-mm gun compartment, APR-39 compartment); components are damaged because of difficult access (e.g., driveshafts, optical relay tube); certain components are mounted in an awkward position in the aircraft, thereby hindering accessibility (e.g., ECU, TADS-PNVs, air data processor); performing blind adjustments on specific components (e.g., ECU, 30-mm gun components, radar altimeter) is difficult; and reading hydraulic gauges is difficult because of their location and small size. Positive responses included maintainers reporting that footholds and handholds are adequate for accessing aircraft components and that there are a sufficient number of maintenance stands provided to them.

#### Fasteners

When asked about problems they experience with aircraft component fasteners (e.g., latches, bolts, screws), maintainers reported that fastening and unfastening tail rotor gearbox access panel fasteners is difficult and time consuming, screws and bolts become stripped and rounded; components need captive fasteners to expedite maintenance task times and reduce foreign object debris (FOD), including the left and right 90 and 545 panels; and having to fasten and unfasten different types of fasteners slows removal and replacement of components.

#### Connectors

When asked about problems they experience with aircraft component connectors, maintainers reported that several connectors are difficult to work with, including fuel system, PNVs, and APR-39 connectors; some connectors can be accidentally inserted into a wrong connector end or housing (e.g., BUCS, TADS-PNVs, and APR-39 connectors); some connectors often accidentally get broken, including antenna connectors, PNVs connectors, and APR-39 connectors; APR-39, radar altimeter and radio connectors come loose on their own; cables and hoses have to be bent or sharply twisted to make a connection, including TADS-PNVs compartment cables and hoses and ALQ-136 cables; some components need additional service loop in their wires and harnesses, including TADS-PNVs compartment components and aircraft radios; and the need to replace Raychem connectors with cannon plug connectors.

## Labels and Markings

When asked about problems regarding labels and markings on the aircraft, maintainers reported that labels and markings are often missing on components including wires, cables, and the main rotor system; certain labels and markings are difficult to read because of location (e.g., main rotor system, TADS-PNVS); fading of labels and markings makes them difficult or impossible to read; and difficulty reading labels and markings while wearing mission-oriented protective posture (MOPP) IV gear because of the visual restrictions of the mask.

## Lifting and Carrying

When asked about problems pertaining to lifting and carrying components, maintainers reported that components that need handles to make them easier to remove, replace, and carry include the aircrew seats, 30-mm gun ammunition system, the ALQ-144 and ALQ-136; components that are too awkward to be easily lifted by the specified number of personnel include gearboxes and the 30-mm gun turret; and the need to provide more carts to move components.

## Removal and Replacement

When asked about problems regarding removal and replacement of components, maintainers reported that components that are the most difficult to remove and replace include the transmission, TADS-PNVS compartment components, APR-39 receivers, inertial particle separators, and hydraulic pressure swaging; supply parts that are not readily available at AVUM include main rotor supply parts, TADS-PNVS supply parts, splices, common hardware (e.g., bolts, screws), and gas generator components; a significant percentage of maintainers reported that lack of getting supply parts in a timely manner frequently keeps aircraft from being mission ready; and components that should be repaired at AVUM instead of AVIM include certain rotor system components, the aircraft interface assembly, G-axis seals, and power train seals. Positive responses included maintainers reporting that supply forms and records are easy to use.

## Operational Checks

When asked about problems they experience while performing operational checks on aircraft components, maintainers reported that they have the most difficulty performing operational checks on Hellfire missiles, the 30-mm gun and the Doppler system. Maintainers further reported that one of the most significant improvements that could be made to reduce the time required to perform operational checks is to eliminate unnecessary steps in the fault isolation procedures.

## Periodic and Phase Inspection

When asked about problems they experience when performing periodic and phase inspection on the aircraft, maintainers reported that the most difficult components to inspect include the auxiliary power unit, main rotor components, 30-mm gun system, and APR-39 primarily because access to the components is difficult. Maintainers also reported that the main rotor strap pack, which is a safety-of-flight part, is difficult to inspect in a thorough manner; cleaning fluids they need to perform inspection tasks, which are not provided at AVUM, include a good substitute for trichloro-trifluoroethane, alcohol, and a good, all-purpose cleaner; the need for an armament phase book to aid in performing inspections. Positive responses included maintainers reporting that DA Forms 2408-13 and 14 are easy to use for recording problems with the aircraft.

## Technical Manuals

When asked about problems they experience when using technical manuals, maintainers reported that the diagrams need to be more accurate and detailed; problems finding an adequate location to place their technical manual while working on the aircraft; and the need to automate technical manuals by hosting them on a laptop computer. Positive responses included maintainers reporting that the format of the technical manuals is easy to follow and understand, and the information is adequate for servicing, removing, and replacing components.

## Training

When asked about problems regarding training they have received to maintain the aircraft, a large percentage of maintainers rated schoolhouse training as "very inadequate," "moderately inadequate," or "borderline." The reasons given for these ratings included lack of in-depth instruction and lack of qualified instructors. A large percentage of maintainers reported that they "never" train with MOPP IV gear; and a significant percentage of maintainers reported that they "never" or "seldom" train with combat gear. A large percentage of maintainers reported that the training they receive with MOPP IV gear, cold weather gear, and combat gear is not sufficient; and 67R personnel reported they need more APU qualification training for their MOS. Positive responses included maintainers reporting that maintenance safety is adequately covered during training.

## Maintenance Process

No significant comments were reported for this section.

## Safety

When asked about safety problems they experience while working on the aircraft, maintainers reported that they have experienced problems with hot surfaces (e.g., avionics, hot aircraft surface temperatures because of the sun), fluid spills (e.g., hydraulic fluid, oil), sharp surfaces (e.g., screws, clamps, cotter pins), electrical hazards (exposed wiring) and falling off the aircraft because of limited surface area for working.

## Effects of Clothing

When asked about problems they experience while wearing personnel protective gear and clothing, maintainers reported that they have experienced problems performing maintenance tasks while wearing MOPP IV gear, cold weather gear, and combat gear because of restriction of movement, bulkiness, lack of dexterity, and difficulty seeing with the MOPP IV mask.

## Manpower Requirements

When asked how often they need more personnel than specified in the technical manual to assist them in performing their maintenance tasks, maintainers reported that for most maintenance tasks, they “never” or “some of the time” need more personnel to assist them.

## Tool Requirements

When asked about tools they need that are not provided to them at AVUM, maintainers reported that they need multimeters, torque wrenches, “dogbone” wrenches, and socket wrenches.

## Overall Difficulty of Maintenance

When asked to rate the ease or difficulty of performing maintenance tasks on the aircraft, a large percentage of 67R, 68X, and 68N personnel rated the AH-64 as “moderately difficult” or “borderline” to maintain.

## Summary of Lessons Learned

### Troubleshooting

Lesson Learned: 67R, 68X, and 68N maintainers reported that the FDLS is often



unreliable as it frequently identifies the wrong components as being at fault or identifies a problem that does not exist. 68X personnel are the primary users of the FDLS and were the most critical in their responses. (See questions TS1, TS2, TS3, TS4, and TS8.)

Discussion: The lack of FDLS reliability increases maintenance task times by causing unnecessary troubleshooting. Maintainers often remove and replace components that are functioning correctly because FDLS has erroneously identified the component as faulty.

Improvements in the reliability of the FDLS would reduce troubleshooting task time lines by allowing maintainers to quickly and accurately diagnose fault conditions on the aircraft, thereby expediting the repair process.

Lesson Learned: 68R, 68X, and 68N maintainers reported that the troubleshooting manuals they use are vague, often do not fully address problems they experience, and are sometimes inaccurate. (See questions TS5, TS8, and TS9.)

Discussion: Incomplete, vague, and inaccurate troubleshooting manuals increase maintenance task times as maintainers must take additional time to determine what problem exists or perform unnecessary troubleshooting tasks in order to identify and correct a problem they experience. Additionally, the potential for incorrectly performing a maintenance task is increased if the content of the troubleshooting manual is incorrect, vague, or incomplete. Providing complete, current, and accurate troubleshooting manuals would expedite the repair process and reduce the probability of incorrect and potentially unsafe maintenance tasks being performed on the aircraft.

#### Accessibility

Lesson Learned: A significant percentage of 67R personnel (63%), 68X personnel (41%), 68N personnel (41%), and 68B personnel (40%) reported that there are an inadequate number of access panels on the aircraft for accessing components. The primary areas where the number of access panels should be increased included the crew station compartment for access to the lower flight controls (67R), the left and right 60 panel for accessing the MRTU Type 1 (68X), and for access to the APR-39 components (68N). (See question AC1.)

Discussion: Lack of an adequate number of access panels limits maintainer access to components, thereby increasing maintenance task times and delaying aircraft from being mission ready. It also increases the potential for maintainer injury and damage to components because of difficult access. Improving access to components in the AH-64 by increasing the

number of access panels would expedite the repair process and reduce the potential for personnel injury and component damage.

Lesson Learned: The majority of 67R personnel (53%) reported that the sizes of the access panel openings on the aircraft are inadequate to perform the required tasks. The primary area where access is inadequate was the horizontal stabilator bolts access panel. (See question AC3.)

Discussion: 67R personnel perform most of the maintenance tasks on the aircraft. Access panels that are too small to adequately access components increase maintenance task times, thereby delaying aircraft from being mission ready. They also increase the potential for maintainer injury and damage to components because of difficult access. Improving access to components in the AH-64 by increasing the size of access panels would expedite the repair process and reduce the potential for personnel injury and component damage.

Lesson Learned: Most 67R personnel (71%), 68X personnel (61%), and 68N personnel (60%) reported that access panels are not easy to open and remove. The panels reported most frequently cited as difficult to open and remove included the tail rotor gearbox panel (67R), left and right 200 panels (67R), left and right 90 panels (68X), and bottom panels on the aircraft (68X). (See question AC4).

Discussion: Access panels that are difficult to open and remove increase maintenance task times, thereby delaying aircraft from being mission ready. They also increase the potential for damage to the access panel. Reducing the number of fasteners on access panels and improving accessibility to the panels would expedite the repair process and reduce the potential for component damage.

Lesson Learned: Personnel reported that there is significant interference from surrounding components when servicing or removing and replacing certain aircraft components. The most frequently cited components included environmental control unit components (67R), APU components (67R), shaft-driven compressor (67R), fuel system components (67R), fire extinguisher bottles (67R), TADS-PNVS compartment components (68X), air data processor (68X), APR-39 receivers (68N), the HARS (68N), and G-axis components (68B). (See question AC5.)

Discussion: Interference from surrounding components while accessing other components increases maintenance task times, thereby delaying the aircraft from being mission ready. It also increases the potential for component damage because of difficult access. Minimizing interference from surrounding components would expedite the repair process and reduce the potential for damage to components.

Lesson Learned: Personnel reported that they do not have sufficient workspace to easily service remove and replace certain aircraft components. The most frequently cited components included environmental control unit components (67R), APU compartment components (67R), crew station compartment components (67R), fire extinguisher bottles (67R), 30-mm gun ammunition system components (68X), APR-39 receivers (68N), and the HARS (68N). (See question AC6.)

Discussion: Insufficient work space for accessing components increases maintenance tasks times, thereby delaying aircraft from being mission ready. It also increases the potential for maintainer injury and component damage because of difficult access. Improving access to components by increasing maintainer work space would expedite the repair process and reduce the potential for personnel injury and component damage.

Lesson Learned: Personnel reported that some aircraft components require a significant amount of time to access because of interference from other components. The most frequently cited components included crew station compartment components (primarily the lower flight controls and blast shield) (67R), fuel system components (67R), environment control unit compartment components (67R), fire extinguisher bottles (67R), 30-mm gun and ammunition system components (68X), TADS-PNVS compartment components, the air data processor (68X), APR-39 receivers (68N), and the HARS (68N). (See question AC7.)

Discussion: Components that require a significant amount of time to access because of interference from other components increase maintenance task times, thereby delaying aircraft from being mission ready. They also increase the potential for maintainer injury and component damage. Minimizing interference from surrounding components would expedite the repair process and reduce the potential for personnel injury and component damage.

Lesson Learned: Maintainers reported that certain aircraft components get damaged because of difficult access. The most frequently cited components included driveshafts

(67R and 68D), the optical relay tube (68X), and TADS-PNVS components (68X). (See question AC8.)

Discussion: Damaged components can be expensive and time consuming to replace, thereby decreasing aircraft availability. Efforts to protect aircraft components from damage by use of protective covers, design modifications or changes in maintenance procedures need to be investigated.

Lesson Learned: Maintainers reported that some components are difficult to access because they are mounted in an awkward position on the aircraft. The most frequently cited components included gearbox components (67R), environmental control unit components (67R), crew station compartment components (67R), fire bottles (67R), shaft driver compressor (67R), APU (67R), TADS-PNVS compartment components (68X), air data processor (68X), and the APR-39 (68N). (See question AC9.)

Discussion: Difficult access to components increases maintenance task times, thereby delaying aircraft from being mission ready. It also increases the potential for injury to maintainers and damage to aircraft components because of difficult access. Mounting aircraft components in an easily accessible position would expedite the repair process and reduce the potential for personnel injury and component damage.

Lesson Learned: Maintainers reported that they have problems performing blind adjustments of environmental control unit components (67R), APU components (67R), gearbox components (67R), fuel system components (67R), 30-mm gun components (68X), the radar altimeter (68N), and the APR-39 receivers (68N). (See question AC10.)

Discussion: Having to perform blind adjustments of components is often a difficult task and can result in improper adjustments and damage to components. Improper adjustments can result in a safety hazard. The requirement to blindly adjust aircraft components should be eliminated or minimized to the maximum extent practical.

Lesson Learned: The majority of maintainers reported that footholds and handholds on the aircraft are adequate for accessing components. They did express a desire for additional footholds and handholds on the right side of the aircraft to access the main rotor head components (67R). (See question AC11.)

Discussion: Future modifications of the aircraft should ensure that footholds and handholds remain adequate for accessing components. Additionally, the possibility of placing additional footholds and handholds on the right side of the aircraft should be evaluated.

Lesson Learned: The majority of maintainers reported that they have a sufficient number of maintenance stands at AVUM for servicing, removing and replacing of components. (See question AC13.)

Discussion: Maintenance stands are important for performing maintenance tasks on certain parts of the aircraft that are difficult to access (e.g., tail rotor) or require removal of heavy components (e.g., TADS-PNVS).

Lesson Learned: 67R personnel reported that the hydraulic gauges are difficult to read because of location or size. (See question AC15.)

Discussion: Gauges that are difficult to read increase maintenance task times and potential for misreading the gauge. An evaluation to determine the feasibility of improving readability of the hydraulic gauges should be initiated to address the problems reported by the maintainers.

#### Fasteners

Lesson Learned: Maintainers reported that they have problems fastening and unfastening certain fasteners used on the aircraft. The most frequently cited fasteners included tail rotor gearbox access panel fasteners (67R), trouble fastening and unfastening screws because of the length of time required or screws getting stripped and rounded (68X and 68N), and problems unfastening bolts because they get stripped or rounded smooth (68X). (See question FA1.)

Discussion: Difficulty fastening and unfastening screws and bolts increases maintenance task times, thereby delaying aircraft from being mission ready. It also increases the potential for damage to the screws, bolts, access panels, and components. Improvements in accessibility to fasteners, fatigue life and strength of fasteners and fastener retainers that are used on the aircraft would expedite the repair process, minimize aircraft down time, and reduce the potential for component damage.

Lesson Learned: Maintainers reported that components that need captive fasteners the most are the left and right 90 panels (68X) and left and right 545 panels (67R). (See question FA2.)

Discussion: Captive fasteners can reduce maintenance task times and enhance safety since non-captive fasteners are easily dropped or lost, potential FOD, easily mixed with fasteners from other components, potentially causing the wrong fastener to be re-inserted and annoying to maintainers who have to bag and label them. Captive fasteners should be incorporated into future modifications of the aircraft to the maximum extent possible.

Lesson Learned. Thirty-seven percent of 67R personnel, 20% of 68X personnel, 19% of 68N personnel, and 20% of 68B personnel reported that they accidentally lose non-captive fasteners (e.g., bolts, washers) 20% to 30% of the time when servicing or removing and replacing components. (See question FA3.)

Discussion: Captive fasteners can reduce maintenance task times and enhance safety since non-captive fasteners are easily dropped or lost, potential FOD, easily mixed with fasteners from other components, potentially causing the wrong fastener to be re-inserted and annoying to maintainers who have to bag and label them. Captive fasteners should be incorporated into future modifications of the aircraft to the maximum extent possible.

Lesson Learned: Fifty-three percent of 67R maintainers, 59% of 68X personnel, and 57% of 68N personnel reported that having to fasten and unfasten different types of fasteners moderately to significantly slows removal and replacement components. (See question FA5.)

Discussion: Having to fasten and unfasten different types of fasteners while performing a maintenance task is time consuming and increases the potential for inserting a wrong fastener into an access panel or component. An effort to determine the feasibility of reducing the number and types of fasteners on the aircraft should be undertaken to address the problems reported by the maintainers.

#### Connectors

Lesson Learned: Maintainers reported that connectors that are difficult to connect and disconnect during servicing, removal and replacement of components include fuel system component connectors (67R), hydraulic system component connectors (67R), PNVs connectors

(68X), Hellfire launcher connectors (68X), connectors in the aircraft stub wings (68X), TADS connectors (68X), Raychem connectors (68X), and APR-39 connectors (68N). (See question CN1.)

Discussion: Difficulty connecting and disconnecting connectors increases maintenance task times, thereby delaying aircraft from being mission ready. It also increases potential for damage to the connectors and components. Improvements in accessibility and the method in which connectors are mated should be made during modifications of the aircraft to address the problems reported by the maintainers.

Lesson Learned: Twenty-seven percent of 67R personnel, 75% of 68N maintainers, and 46% of 68X maintainers reported that some connectors can be accidentally inserted into a wrong connector end or housing. They include BUCS servo connectors (67R), environmental connectors (67R), spindle connectors (67R), rocket pod connectors (67R and 68X), ADS mast power cables (67R), temperature alarm connectors (67R), TADS-PNVS connectors (68X), APR-39 connectors (68N), and transponder connectors (68N). As reported in question CN3, few maintainers reported experiencing a safety problem or damage to equipment when a connector was accidentally inserted into a wrong connector end or housing. However, the results can be severe (e.g., electrical shock, component malfunction) if this occurs. (See question CN2.)

Discussion: Accidentally inserting a connector into a wrong connector end or housing creates the potential for breaking the connector and could result in a safety hazard. Connectors should be keyed to prevent accidental insertion into a wrong connector.

Lesson Learned. 68X personnel reported that when making a blind mate connection, PNVS connectors get bent or broken. (See question CN4.)

Discussion: Connectors that often accidentally get broken result in the aircraft being unavailable to conduct a mission until the connector is fixed. Improving access to connectors and procedures for connecting and disconnecting as well as increasing their fatigue life would minimize aircraft down time and reduce the potential for component damage.

Lesson Learned: Maintainers reported that the primary connectors that often accidentally get broken include antenna connectors (67R and 68N), transducers (67R), T-355 connectors (67R), IHADSS-ICS connectors (67R and 68X), PNVS connectors (68X), remote

Hellfire electronics connectors (68X), APR-39 connectors (68N) and ALQ-136 connectors (68N). (See question CN5.)

Discussion: Connectors that often accidentally get broken result in the aircraft being unavailable to conduct a mission until the connector is fixed. Improving access to connectors and procedures for connecting and disconnecting as well as increasing their fatigue life would minimize aircraft down time and reduce the potential for component damage.

Lesson Learned: 67R and 68N personnel reported that APR-39 connectors often come loose on their own as well as radar altimeter connectors and radio antenna connectors (68N). (See question CN6.)

Discussion: Connectors that often come loose on their own can result in loss of component function and be a potential safety hazard. Improving connector retention would reduce the potential for losing component function during flight operations and therefore minimize the potential for a safety hazard.

Lesson Learned: Sixty-seven percent of 68X personnel and 53% of 68N personnel reported they have to bend or sharply twist cables or hoses when making a connection because of the location or position of a component. The cables and hoses reported include TADS-PNVS compartment cables and hoses (68X), Hellfire launcher cables (68X), ALQ-136 cables (68N) APR-39 cables (68N), and radio cables (68N). (See question CN7.)

Discussion: Having to bend or sharply twist cables or hoses when making a connection increases the potential for damage to the cable, hose, and component. Improving the location or position of the component to eliminate bending or twisting of cables and hoses would minimize the potential for component damage.

Lesson Learned: Seventy-five percent of 68X personnel and 54% of 68N personnel reported that some components do not have enough service loop in their wires and harnesses to easily make a connection. The components include TADS-PNVS compartment components (68X), crew station compartment components (68X), and aircraft radios (68N). (See question CN8.)

Discussion: Lack of adequate service loop in wires and harnesses results in maintainers having to strongly pull on the wires and harnesses to make a connection. This



increases potential for damage to the wires and harnesses and the components to which they connect. Ensuring adequate service loop is provided for wires and harnesses would minimize the potential for component damage.

Lesson Learned: 68X personnel reported that one of the most significant improvements that could be made to reduce the time needed to connect and disconnect component connectors is to install more cannon plug connectors on aircraft components. (See question CN9.)

Discussion: Cannon plugs are easier to connect and disconnect than the Raychem connectors that are used on certain components maintained by 68X personnel (e.g., PNVS connector). The cannon plug twists off and on while the Raychem connector has to be secured into the receptacles with screws. Having to screw Raychem connectors into receptacles can be difficult and time consuming, especially in tight areas. An evaluation to determine the feasibility of replacing Raychem connectors with cannon plugs should be conducted to address this problem.

#### Labels and Markings

Lesson Learned: 60% of 67R personnel, 72% of 68X personnel, and 59% of 68N personnel reported that labels or markings on aircraft components are often missing. They include wires and cables (67R, 68X, 68N, and 68D), and main rotor system, servo cylinders, and gearbox labels and markings (67R). (See question L-M1a.)

Discussion: Labels and markings that are missing require maintainers to consult a maintenance manual to identify wires, cables, and components or to obtain a part number. This is annoying to maintainers and increases maintenance task times, thereby delaying aircraft from being mission ready. Also, it could result in a safety hazard if wires, cables, or components are misidentified. Improving the labeling and marking of wires, cables, and components (e.g., stronger adhesives, dyes) would expedite the repair process and reduce the potential for misreading a label or marking.

Lesson Learned. Fifty-nine percent of 67R personnel, 65% of 68X personnel, and 53% of 68N personnel reported that labels and markings are difficult to read due to their location. These included main rotor system labels and markings (67R) and TADS-PNVS labels and markings (68X). (See question L-M2b.)

Discussion. Improving the location of labels and markings on components to increase their viewability would expedite the repair process and reduce the potential for misreading a label or marking.

Lesson Learned: Sixty-one percent of 67R personnel, 67% of 68X personnel, and 69% 68N personnel reported that labels and markings are difficult to read because of fading of the label and marking. (See question L-M2c.)

Discussion: Labels and markings that are difficult to read because of fading require maintainers to consult a maintenance manual to identify wires, cables, and components or to obtain a part number. This is annoying to maintainers and increases maintenance task times, thereby delaying aircraft from being mission ready. Improving the labeling and marking of wires, cables, and components (e.g., stronger dyes) would expedite the repair process and reduce the potential for misreading a label or marking.

Lesson Learned: 67R, 68X, and 68N personnel commented that labels and markings are difficult to identify and read while wearing MOPP IV gear. (See question L-M6.)

Discussion: Peripheral visual restrictions and distortions caused by the MOPP IV mask that maintainers wear make it difficult to read labels and markings on aircraft components. Development efforts, including the XM-45 mask, need to ensure effective viewability of labels and marking on aircraft components.

#### Lifting and Carrying

Lesson Learned: Maintainers reported that components that need handles to make them easier to remove and replace include the APU (67R), aircrew seats (67R), gearboxes (67R and 68D), 30-mm gun ammunition magazine (68X and 67R), TADS-PNVS components (68X), the ALQ-144 (68N), and the ALQ-136 (68N). (See question L-C1.)

Discussion: Removal and replacement of components that are heavy, cumbersome, or fit in confined space increases maintenance task times, thereby delaying aircraft from being mission ready. It also increases the potential for maintainer injury and damage to components. Investigation into the feasibility of installing handles or providing suitable grasp areas on the components listed should be conducted.

Lesson Learned: Maintainers reported that components that are too awkward to be easily lifted by the specified number of personnel include gearboxes (67R), aircrew seats (67R), and the 30-mm gun turret (68X). (See question L-C3.)

Discussion: Components that are too awkward to be easily lifted by the specified number of personnel increase maintenance task times, potential for maintainer injury and damage to components. Investigation into the feasibility of installing handles or providing suitable grasp areas on the components listed should be conducted.

Lesson Learned: Maintainers reported that components that are difficult or awkward to carry to or from the aircraft include the aircrew seats (67R), 30-mm gun turret (68X), TADS-PNVS components, ALQ-136 (68N), and ALQ-144 (68N). (See question L-C6.)

Discussion: Components that are difficult or awkward to be carried to or from the aircraft increase maintenance task times, potential for maintainer injury and damage to components. Investigation into the feasibility of installing handles or providing suitable grasp areas on the components listed should be conducted.

Lesson Learned: 67R and 68X personnel commented that one of the most significant improvements that could be made to reduce the time needed to lift and carry components is to provide more carts. (See question L-C8.)

Discussion. Lack of carts for moving components increases the time required for transporting them and increases the risk of maintainer injury and equipment damage. Units should ensure that their maintainers have an adequate number of carts to use on the flight line and in the maintenance hangar.

#### Removal and Replacement

Lesson Learned: Maintainers reported that the components that are most difficult to remove and replace include the transmission (67R), fuel cells (67R), gearboxes (67R), APU (67R), environmental control unit (67R), shaft driver compressor (67R), TADS-PNVS compartment components (68X), 30mm gun system components (68X), APR-39 receivers (68N) and the HARS (68N), the inertial particle separator (68B), and the hydraulic pressure swaging (68D). (See question RR1.)

Discussion: Components that are difficult to remove and replace because of location, size, weight, and so forth, result in increased maintenance task times, thereby delaying aircraft from being mission ready. They also increase the potential for maintainer injury and component damage. Improving component location, size, weight, and so forth, would expedite the repair process decrease the potential for maintainer injury and damage to components.

Lesson Learned: Maintainers reported that component supply parts that are not readily available at AVUM include main rotor system supply parts (67R and 68D), common supply parts (67R and 68D), common hardware (e.g., nuts, bolts) (67R), transducers (67R) and TADS-PNVS components (68X), splices (68N), gas generator components (68B), and main rotor-tail rotor components (68D). (See question RR2.)

Discussion: Lack of available supply parts results in aircraft not being mission ready or cannibalization of parts from other aircraft. Maintainers reported in question RR6 that lack of readily available supply parts frequently keeps aircraft from being mission ready. Improvements in the aviation supply system to alleviate component supply part shortages should be investigated to resolve the problems reported by the maintainers.

Lesson Learned: Most maintainers indicated that they experience no problems using supply forms and records. (See question RR3.)

Discussion: Supply forms and records that are easy to complete and contain all the needed information help expedite the repair process.

Lesson Learned: Maintainers reported that they often run out of the following supply parts at AVUM: common hardware (67R and 68B), main rotor system components (67R and 68B), transducers (67R), filters (67R), TADS-PNVS parts (68X), 30-mm gun system parts (68X), splices (68X and 68N), extractors (68X), ARN-149 parts (68N), and APR-39 parts (68N), G-axis seals (68B), and gearbox parts (68D). (See question RR4.)

Discussion: Lack of available supply parts results in aircraft not being mission ready or cannibalization of parts from other aircraft. Maintainers reported in question RR6 that lack of readily available supply parts frequently keeps aircraft from being mission ready. Improvements in the aviation supply system to alleviate component supply part shortages should be investigated to resolve the problems reported by the maintainers.

Lesson Learned: Maintainers reported that the supply parts that take the longest to receive after they have been ordered include main rotor system parts (67R) and 68D), transducers (67R), TADS-PNVS parts (68X), 30-mm gun system parts (68X), common hardware (68X), cannon plugs (68X), splices (68N), the video recorder (68N), and ARN-149 (68N). (See question RR5.)

Discussion: Lack of readily available supply parts results in aircraft not being mission ready or cannibalization of parts from other aircraft. Maintainers reported in question RR6 that lack of readily available supply parts frequently keeps aircraft from being mission-ready. Improvements in the aviation supply system to alleviate component supply part shortages should be investigated to resolve the problems reported by the maintainers.

Lesson Learned: Sixty-three percent of 67R personnel reported that failure to receive supply parts in a timely manner frequently keeps the aircraft from being mission ready; 48% of 68X personnel reported that the failure to receive supply parts in a timely manner frequently keeps the aircraft from being mission ready; 72% of 68N personnel reported that failure to receive supply parts in a timely manner frequently keeps the aircraft from being mission ready; and 62% of 68D personnel reported that failure to receive supply parts in a timely manner frequently keeps the aircraft from being mission ready. (See question RR6.)

Discussion: Lack of available supply parts results in aircraft not being mission ready or cannibalization of parts from other aircraft. Improvements in the aviation supply system to alleviate component supply part shortages should be investigated to resolve the problems reported by the maintainers.

Lesson Learned: Maintainer personnel reported that components that are repaired at AVIM, which should be repaired at AVUM, include rotor system components (67R), the aircraft interface assembly (68X), G-axis seals (68B), and "most or all components" (67R and 68X) and seals (68D). (See question RR10.)

Discussion: The capability to repair certain components at the AVUM level instead of the AVIM level could decrease overall maintenance repair time lines by decreasing the time and paperwork required to have AVIM personnel repair components.

#### Operational Checks

Lesson Learned: Maintainers reported that components that are the most difficult

to perform operational checks on include Hellfire missiles (68X), 30-mm gun (68X), Doppler (68N), the HARS (68N), and video recorder (68N). (See question OC1.)

Discussion: Operational checks that are difficult to perform because of their excessive length or lack of specific instruction in the maintenance manuals increase maintenance task time lines, thereby delaying aircraft from being mission ready. Any steps that can be eliminated or shortened during operational checks, as well as revising the maintenance manuals to include more specific instruction, should be investigated.

Lesson Learned: 67R personnel reported that one of the most significant improvements that could be made in the AH-64 to reduce the time needed to perform operational checks is to make the operational checks more specific to the actual problem and therefore less time consuming. (See question OC3.)

Discussion: Operational checks that are difficult to perform because of their excessive length or lack of specific instruction in the maintenance manuals increase maintenance task time lines, thereby delaying aircraft from being mission ready. Any steps that can be eliminated or shortened during operational checks, as well as revising the maintenance manuals to include more specific instruction, should be investigated.

#### Periodic and Phase Inspection

Lesson Learned: Maintainers reported that components which are the most difficult to inspect include the APU (67R), main rotor components (67R and 68D), environmental control unit (67R), 30-mm gun system (68X), and the APR-39 (68N). This is primarily attributable to a lack of easy access to the components. (See question IN1.)

Discussion: The inability to quickly inspect components increases maintenance task time lines, thereby delaying aircraft from being mission ready. Improving access to components would expedite the inspection process and thereby decrease aircraft down time.

Lesson Learned: Maintainers reported that DA Forms 2408-13/14 are easy to follow and understand for recording problems with the aircraft and have a sufficient number of information blocks. (See question IN2.)

Discussion: Forms that are easy to follow and understand for recording problems with the aircraft and that contain a significant number of information blocks help expedite the repair process.

Lesson Learned: 67R and 68D personnel reported that the main rotor strap pack, which is a safety-of-flight part, is difficult to inspect in a thorough manner. (See question IN4.)

Discussion: The main rotor strap pack requires inspection with a borescope, which is not an easy task to perform. Efforts to improve the method of inspecting the strap packs need to continue.

Lesson Learned: Maintainers reported that the following cleaning fluids needed to perform inspection tasks are not provided at AVUM: a good substitute for trichlorotrifluoroethane (67R, 68X, and 68N), alcohol, and a good, all-purpose cleaner (67R). (See question IN6.)

Discussion: Lack of effective cleaning fluids requires maintainers to spend a lot of time cleaning components. Efforts to identify and provide effective cleaning fluids for field use should continue.

Lesson Learned: 68X personnel reported that one of the most significant improvements that could be made in the AH-64 to reduce the time needed to perform inspections is to provide an armament phase book. (See question IN7.)

Discussion: An armament phase book would provide inspection criteria for 68X personnel to use to conduct a thorough inspection of the aircraft. An effort to determine the feasibility of developing an armament phase book should be initiated.

#### Technical Manuals

Lesson Learned: Maintainers reported that the format of the technical manuals is easy to follow and understand and the information adequate for servicing, removing and replacing components. (See question TM1.)

Discussion: Technical manuals that are easy to follow and understand and contain adequate information for servicing, removing, and replacing of components help expedite the repair process.

Lesson Learned: Maintainers reported that the diagrams of components in the technical manuals are easy to understand, but they need to be more accurate and detailed (67R, 68X, and 68N). (See question TM3.)

Discussion: Diagrams that are not accurate or detailed can result in maintainers performing incorrect or unnecessary maintenance procedures. Efforts to ensure that complete and accurate diagrams are contained in the technical manuals provided to the field should continue.

Lesson Learned: Maintainers reported that they experience problems finding an adequate location to place their technical manual for reading while working on the aircraft (67R, 68X, and 68N) and the wind blows the pages or book around the aircraft (68X and 68N). (See question TM9.)

Discussion: Maintainers need to have their technical manual within easy reading distance so they can follow the repair steps listed while performing their maintenance task on the aircraft. Maintainers often have to place their technical manual where it is not readable because of a lack of space. This results in the maintainer often having to climb down from the aircraft to read the next step in the technical manual and climb back up the aircraft to resume the maintenance task. This lengthens the repair process and increases the potential for incorrectly performing a maintenance task since the maintainer does not have the technical manual nearby for easy reference. Efforts to automate the content of technical manuals by hosting them on personal computers and securing them to the aircraft (e.g., hook and pile, suction cups) should continue. Also, investigation into the use of head-mounted displays for providing technical manual content to the maintainer should be conducted.

Lesson Learned: 68X personnel reported that the most significant improvement that could be made to the technical manuals to reduce the time needed to perform maintenance would be to automate the manuals by hosting them on a laptop personal computer. (See question TM10.)

Discussion: Automating the contents of the technical manual on a personal computer reduces the need to refer to different manuals for information and provides a quick method (e.g., keyword searches) for accessing information. Efforts to automate the content of technical manuals by hosting them on personal computers should continue.



## Training

Lesson Learned: Thirty-three percent of 67R personnel, 48% of 68X personnel, 41% of 68N personnel, and 34% of 68B personnel rated schoolhouse training as moderately inadequate or very inadequate, while 27% of 67R personnel, 28% of 68X personnel, 38% of 68N personnel, and 13% of 68B personnel rated it as borderline. The major reasons listed for these ratings included lack of in-depth instruction and lack of qualified instructors. (See question TN4.)

Discussion: Effective schoolhouse training is essential for supplying qualified maintenance personnel to Army units. The depth and breadth of training course content is necessarily limited by time constraints. However, efforts to improve the quality of training maintainers receive at Army schools should continue.

## MOPP IV Gear Training

Lesson Learned: Forty-nine percent of 67R personnel, 41% of 68X personnel, 45% of 68N personnel, 73% of 68B personnel, and 38% of 68D personnel reported that they never train with MOPP IV gear, while 34% of 67R personnel, 54% of 68X personnel, 42% of 68N personnel, 20% of 68B personnel, and 62% of 68D personnel reported they seldom train with MOPP IV gear. (See question TN6.)

Discussion: Army maintainers need to perform maintenance tasks while wearing MOPP IV gear during peace-time operations to achieve a prescribed level of proficiency. This is necessary since the potential exists for maintainers to be required to wear MOPP IV gear during combat operations. Training in MOPP IV gear is often not performed because it is cumbersome, restrictive, and hinders dexterity and vision, thereby significantly impacting the maintainer's capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive MOPP IV gear need to continue.

## Combat Gear Training

Lesson Learned: Twenty-four percent of 67R personnel, 24% of 68X personnel, 47% of 68B personnel, and 25% of 68D personnel reported that they never train with combat gear, while 36% of 67R personnel, 30% of 68X personnel, 29% of 68N personnel, 33% of 68B personnel and 25% of 68D personnel reported they seldom train with combat gear. (See question TN6.)

Discussion: Army maintainers need to perform maintenance tasks while wearing combat gear during peace-time operations to achieve a prescribed level of proficiency. This is necessary since the potential exists for maintainers to be required to wear combat gear during combat operations. Training in combat gear is often not performed because it is cumbersome and restrictive and significantly impacts the maintainer's capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive combat gear need to continue.

Lesson Learned: Sixty-eight percent of 67R personnel, 74% of 68X personnel, 72% of 68N personnel, 80% of 68B personnel, and 62% of 68D personnel reported that the amount of training they receive for maintaining components while wearing MOPP IV gear is not sufficient. (See question TN7.)

Discussion: Army maintainers need to perform maintenance tasks while wearing MOPP IV gear during peace-time operations to achieve a prescribed level of proficiency. This is necessary since the potential exists for maintainers to be required to wear MOPP IV gear during combat operations. Training in MOPP IV gear is often not performed because it is cumbersome, restrictive, and hinders dexterity and vision, thereby significantly impacting the maintainer's capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive MOPP IV gear need to continue.

Lesson Learned: Forty-three percent of 67R personnel, 41% of 68X personnel, 47% of 68N personnel, 40% of 68B personnel and 37% of 68D personnel reported that the amount of training they receive for maintaining components while wearing cold weather gear is not sufficient. (See question TN7.)

Discussion: Army maintainers need to perform maintenance tasks while wearing cold weather gear in moderate climates to achieve a prescribed level of proficiency. This is necessary since maintainers are required to wear cold weather gear in extreme weather climates. Training in cold weather gear is often not performed because it is cumbersome and restrictive and significantly impacts the maintainer's capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive cold weather gear need to continue.

Lesson Learned: Forty-eight percent of 67R personnel, 48% of 68X personnel, 47% of 68N personnel, 67% of 68B personnel, and 50% of 68D personnel reported

that the training they receive for maintaining components while wearing combat gear is not sufficient. (See question TN7.)

Discussion: Army maintainers need to perform maintenance tasks while wearing combat gear during peace-time operations to achieve a prescribed level of proficiency. This is necessary since the potential exists for maintainers to be required to wear combat gear during combat operations. Training in combat gear is often not performed because it is cumbersome and restrictive and significantly impacts the maintainer's capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive combat need to continue.

Lesson Learned: Maintainers reported that areas of maintenance safety are adequately covered during schoolhouse and unit level training. (See question TN8.)

Discussion: Safe maintenance practices such as the use of safety wire, adherence to safety warnings and cautions, and proper grounding of electrical components are vital to preventing maintainer injury and damage to components.

Lesson Learned: 67R personnel commented they need more APU qualification training for their MOS. (See question TN9.)

Discussion: 67R personnel need to be qualified to operate the APU to perform maintenance tasks that require power to be applied to the aircraft (e.g., operational checks). Lack of APU-qualified 67R personnel increases maintenance tasks time lines since personnel who are APU qualified must be located and then spend their time operating the APU. Efforts to increase the number of 67R personnel who are qualified to operate the APU should be undertaken.

#### Maintenance Process

No significant comments were reported for this section.

#### Safety

Lesson Learned: Maintenance personnel commented that they have experienced safety problems with hot surfaces on the aircraft. (See question SA1.)

Discussion: The aircraft has several hot surfaces that can burn exposed skin. This is because of high operating temperatures of certain components as well as heating of aircraft surfaces by the sun. Efforts to increase maintainer protection from hot surfaces by design modifications or changes in training and maintenance procedures need to continue during aircraft maintenance design activities.

Lesson Learned: Maintenance personnel commented that they have experienced safety problems with fluid spills. (See question SA1.)

Discussion: Aircraft components frequently leak fluids (e.g., hydraulic fluid, oil) because of deteriorated seals, mating surfaces, or lack of proper maintenance procedures. Fluids can burn exposed skin, be a health hazard, harm the environment, and cause maintainers to slip and fall. Efforts to increase maintainer protection from fluid spills by design modifications or changes in training and maintenance procedures need to continue during aircraft maintenance design activities.

Lesson Learned: Maintenance personnel other than 68N's commented that they have experienced safety problems with sharp surfaces. (See question SA1.)

Discussion: Some items on the aircraft are sharp and can cut exposed skin. These items include safety wire, screws, clamps, and cotter pins. Efforts to increase maintainer protection from sharp surfaces by design modifications or changes in training and maintenance procedures need to continue during aircraft maintenance design activities.

Lesson Learned. 68X and 68N personnel commented that they experienced safety problems with electrical hazards. (See question SA1.)

Discussion: Certain parts of the aircraft can become electrical hazards if not properly maintained. These include exposed wiring and improperly connected cables. Efforts to increase maintainer protection from electrical hazards by design modifications or changes to training and maintenance procedures needs to be a continuing effort during aircraft maintenance design activities.

Lesson Learned. 67R, 68N, and 68D personnel commented experiencing safety problems with falling off the aircraft. (See question SA1.)

Discussion: There is limited surface area on the aircraft for performing maintenance tasks. Maintainers must constantly be aware of where they are positioned while working on the aircraft. This is especially true while working on the “doghouse” fairing or aircraft tail or while climbing up and down the aircraft. Efforts to increase maintainer protection from falling off the aircraft by design modifications or changes in training and maintenance procedures need to continue during aircraft maintenance design activities.

### Effects of Clothing

Lesson Learned: 67R personnel, 68X personnel, and 68N personnel commented that they have experienced problems performing maintenance tasks while wearing MOPP IV and cold weather gear primarily because of restriction of movement, bulkiness, lack of dexterity, and difficulty seeing while wearing the MOPP IV mask. 67R and 68N personnel commented that they have experienced problems performing maintenance tasks while wearing combat gear because of restriction of movement and bulkiness, and 68X personnel commented that they have experienced problems while wearing BDUs. (See question AOC1.)

Discussion: Wearing MOPP IV gear, cold weather gear, and combat gear while performing maintenance tasks is difficult because the gear is cumbersome, restrictive, and hinders dexterity and vision, thereby significantly impacting the maintainer’s capability to effectively complete the maintenance task. Efforts to develop less cumbersome and restrictive protective gear and clothing need to continue.

### Manpower Requirements

Lesson Learned: Maintainers reported that for most maintenance tasks, they “never” or “some of the time” need more personnel than specified in the technical manual to perform their tasks. 68N personnel commented that they need more personnel than specified in the technical manual to assist them while performing operational checks and for removal and replacement of avionics. (See question PR1.)

Discussion: The need to use more personnel than specified in the technical manual results in increased task time lines, delays aircraft from being mission ready, and prevents the personnel who are providing assistance from performing their own assigned maintenance tasks.

## Tool Requirements

Lesson Learned: 67R and 68X personnel commented that they need multimeters that are not provided to them at AVUM when performing troubleshooting tasks. (See question TR1.)

Discussion: Lack of proper tools for performing maintenance tasks increases maintenance task time lines, thereby delaying aircraft from being mission ready and can cause damage to components. Efforts to ensure AVUM personnel have the proper tools should continue.

Lesson Learned: 67R personnel commented that they need torque wrenches, torque adapters, and “dogbone” wrenches that are not provided to them at AVUM when performing removal and replacement tasks. 68X personnel commented that they need 3/8-inch “crow’s feet” socket wrenches, while 68B personnel commented that they need 5/16-inch socket wrenches for removal and replacement tasks. (See question TR1.)

Discussion: Lack of proper tools for performing maintenance tasks increases maintenance task time lines, thereby delaying aircraft from being mission ready and can cause damage to components. Efforts to ensure AVUM personnel have the proper tools should continue.

## Test Equipment Requirements

No significant comments were reported for this section.

## Overall Difficulty of Maintenance

Lesson Learned: A significant percentage of 67R personnel, 68X personnel, and 68N personnel rated the AH-64 as “moderately difficult” to “borderline “ when asked to rate the ease or difficulty of performing maintenance tasks on the aircraft.

Discussion: The level of difficulty that maintainers experience while performing maintenance on the aircraft often relates to how quickly and effectively they can perform their task. Efforts to reduce the level of difficulty required for maintaining the aircraft through design modifications, improvements in training, or changes in maintenance procedures should continue.

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APPENDIX A  
AH-64 MAINTAINABILITY SURVEY RESULTS

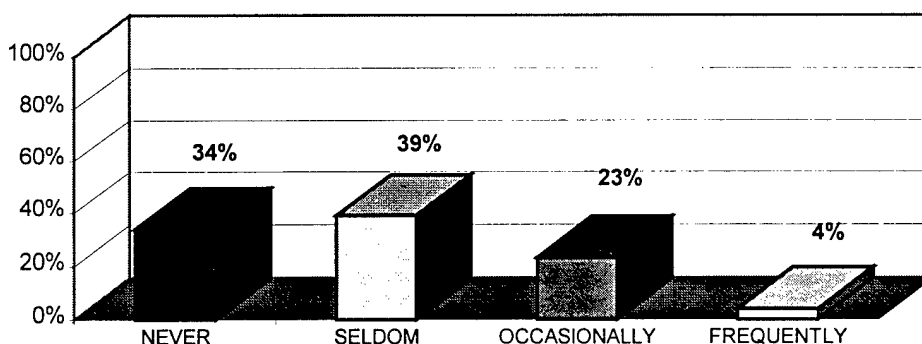


## TROUBLESHOOTING

**TS1. How often do you use the fault detection-location system (FDLS) for troubleshooting AH-64 components? (Check one)**

**Never \_\_\_\_\_ Seldom \_\_\_\_\_ Occasionally \_\_\_\_\_ Frequently \_\_\_\_\_**

### **67R RESPONSES**



### **67R Comments**

#### **FDLS Is Not Often Used Because: (11 Comments)**

FDLS is not often used because many crew chiefs are not APU qualified. Need more crew chiefs who are APU qualified. (4)

As a 67R, we rarely use it because the pilots make the write-ups from FDLS. (4)

Most of your mechanical items are not really connected with FDLS (e.g., hydraulics, fuel). (1)

Seldom due to the fact that I am on a phase team and very rarely on the flight line. (1)

Never use it because we are not sufficiently trained on FDLS. (1)

#### **FDLS is helpful: (5 Comments)**

FDLS is useful for armament troubleshooting. (4)

It helps you to detect faults so you can refer to the TM or the 238 manuals. (1)

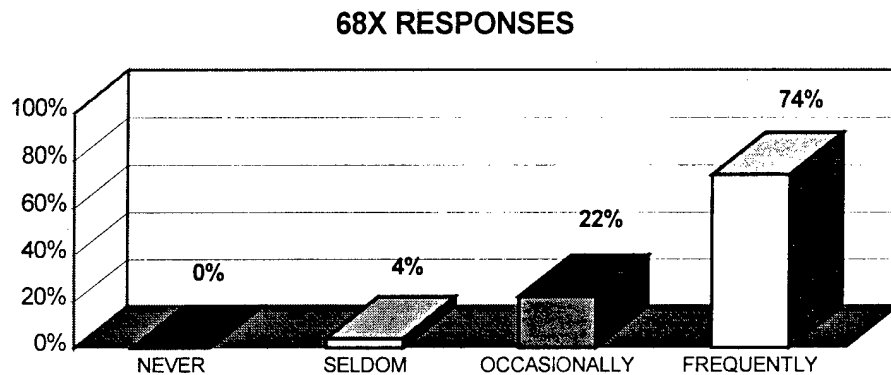
### Problems Using FDLS: (4 Comments)

Frequently points you in the wrong direction. (1)

FDLS flags parts that are not usually causing the problem. (1)

FDLS stops at first fault detected instead of running test through. (1)

For regular maintenance it really doesn't help any. (1)



### 68X Comments

#### Problems with FDLS: (20 Comments).

Always run FDLS if available, but it is not very reliable. (4)

Half the time, FDLS registers the wrong parts as the problem. (3)

Half the time, FDLS doesn't register the faulty equipment. (2)

Should be more in-depth. (2)

Answers should be more specific. (2)

FDLS is often misleading. (1)

FDLS is seldom right. (1)

Production control does not take the advice from FDLS, so more time is spent on troubleshooting. (1)

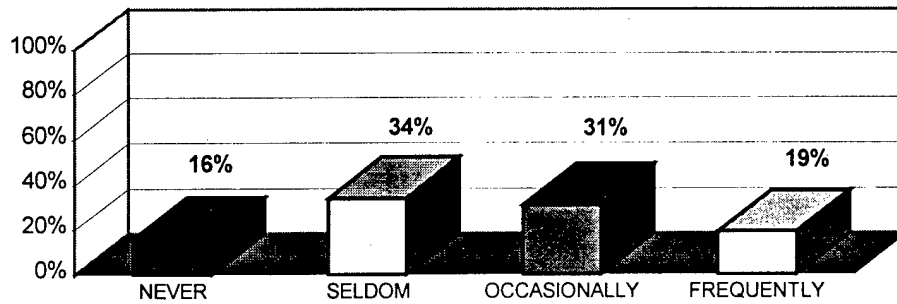
Not as accurate as claimed. (1)

I don't rely on it. (1)

Convenient, but codes are hard to read and time consuming. (1)

Is difficult to scroll through and interpret. (1)

### 68N RESPONSES



### 68N Comments

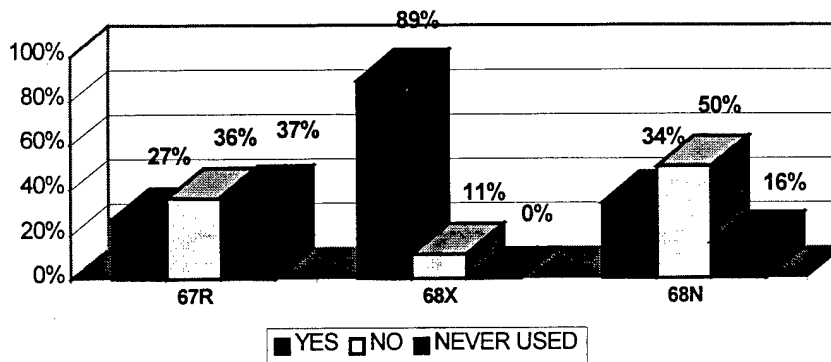
No significant comments.

Note: 68B and 68D MOS personnel do not use the FDLS.

**TS2. Have you experienced any problems using FDLS for troubleshooting AH-64 components?**

Yes \_\_\_\_\_ No \_\_\_\_\_ Never Used \_\_\_\_\_

### MAINTAINER RESPONSES



### 67R Comments

Problems using FDLS: (19 Comments)

Frequently points you in the wrong direction. (4)

Problems at times with stabilator checks. (3)

FDLS will flag no-go without a fault being present on aircraft. (2)  
FDLS system is too vague and rarely addresses the exact problem. (2)  
FDLS fails. (1)  
Sensors fail. (1)  
Electronics monitors not vaguely related to the system indicated. For example, the APU fails due to the temperature transducer on the main transmission. (1)  
Problems at times with BUCS check. (1)  
Have had obvious faults and FDLS gave a "go". (1)  
TEU does not check out "ok" (no-go). (1)  
When flying it will tag something - on the ground it can't duplicate. (1)  
Auto stab has a lot of glitches in the system. (1)

### **68X Comments**

FDLS is not accurate: (47 Comments).

FDLS calls out wrong components. (21)  
FDLS is not very accurate. (4)  
FDLS gives false isolation symptoms. (4)  
With most armament system trouble-shooting, FDLS indicates the TADS Electronic Unit (TEU) is no-go, and for the most part, the TEU is not the problem. (3)  
Many times there is no problem, thereby creating unnecessary troubleshooting. (3)  
FDLS inherently fails a component based on inputs. A majority of failures are due to erroneous or non-existent inputs. (2)  
It often leads you to a wrong start, especially when using the DTA. (2)  
You know you have a problem, but yet it passes. (1)  
FDLS for TADS will give erroneous failures. (1)  
Doesn't give the right component or even near the right component at the start. (1)  
You can run FDLS 10 times and get 10 different faults. (1)  
FDLS may not detect a fault when there is one. (1)  
Sometimes it just messes up. (1)  
It wastes a lot of time sending you on a chase for nothing. (1)  
System is incapable of reading the components at a 100%. The lap top computer can find the fault even if it is a broken wire. (1)

### **68N Comments**

Problems with FDLS. (7 Comments).

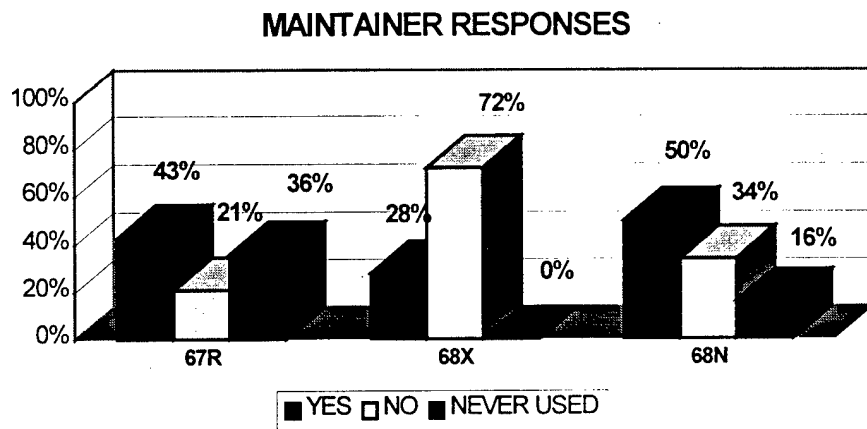
FDLS detects one thing but it usually is something else in the system that is causing the failure. (2)  
Problem understanding fault codes and what they mean. (2)  
Lists only first fault instead of all failed LRTU's. (1)  
Read codes not taught in school (1)

Codes do not reflect actual problems. I use them basically for ruling things out or swapping a component to see if problem went to the other side. (1)

Note: 68B and 68D MOS personnel do not use the FDLS.

**TS3. Can you easily locate the correct component after using FDLS?**

Yes \_\_\_\_\_ No \_\_\_\_\_ Never Used \_\_\_\_\_



**67R Comments**

**Problems using FDLS: (13 Comments)**

Component indicated is not necessarily the black box at fault. (3)

It is too vague. (3)

FDLS flags parts that are not usually the problem. (2)

The FDLS doesn't give the exact location of a component (just the area). (1)

No - It refers to other components that work with the problem you're having. (1)

Not enough information provided by FDLS. (1)

Sometimes system errors were more than a single component - last in series. (1)

Sometimes it's right, sometimes it's wrong. (1)

### **68X Comments**

#### **FDLS is not accurate or thorough: (16 Comments)**

FDLS calls out the wrong problem (6)

It often points you in the wrong direction. (3)

With most armament system troubleshooting, FDLS indicates the TADS Electronic Unit (TEU) is no-go when for the most part, the TEU is not the problem. (2)

Cannot easily locate the correct component most of the time. (2)

FDLS isn't that thorough of a troubleshooter. (2)

Often skips the minor components that cause the major components to fail. (1)

### **68N Comments**

#### **Problems with FDLS specifying failure. (5 Comments)**

The stabilator FDLS should indicate bad relay instead of LRTU. (1)

Sometimes another component causes the good component to fail the FDLS test. (1)

Common sense and experience work better than FDLS. (1)

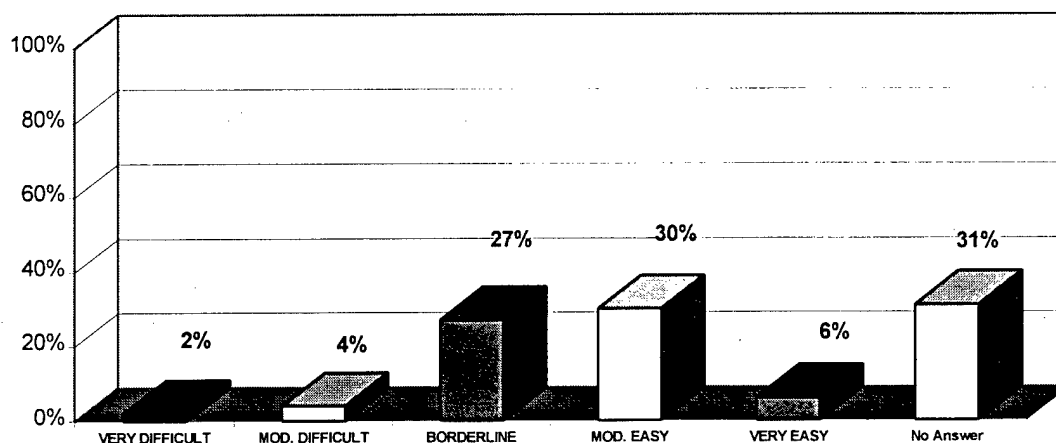
FDLS is not always accurate. (1)

FDLS is not reliable. (1)

**TS4. Rate the ease of using FDLS for troubleshooting component problems.  
(Circle one)**

5	4	3	2	1
<b>Very Difficult</b>	<b>Moderately Difficult</b>	<b>Borderline</b>	<b>Moderately Easy</b>	<b>Very Easy</b>

**67R RESPONSES**



**67R Comments**

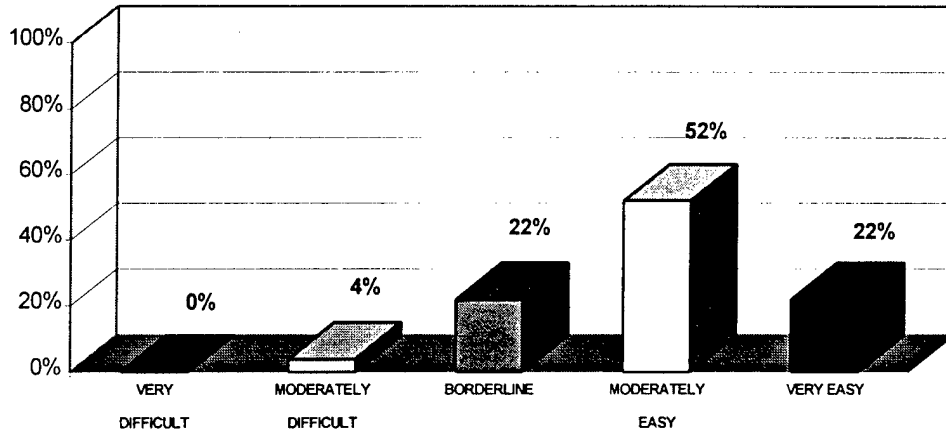
**Problems using FDLS: (7 Comments)**

Sometimes component incompatibility runs you around in circles. (1)  
 I feel lukewarm about FDLS. It's a great device for wire chasing but for hard line mechanical input, it is a hit or miss system. (1)  
 Hard to respond in the proper time. (1)  
 If you don't prompt quickly enough, the FDLS reboots. (1)  
 It doesn't cover a lot of the systems that seem to have problems (e.g., electrical portion of the fuel system) (1)  
 FDLS flags parts that are not usually causing the problem. (1)  
 Sometimes doesn't give you the exact problem - just the general area. (1)

**Have never used FDLS: (7 Comments)**

Never used FDLS. (7)

### 68X RESPONSES



### 68X Comments

#### FDLS is not accurate: (8 Comments)

It's easy to use but its not right most of the time so how can you trust it? FDLS either calls out a problem that's not there or gives you the wrong component. (4)

FDLS calls out the wrong problem. (2)

Sometimes its right, sometimes its wrong. (1)

Easy to use, but unreliable. (1)

#### Other problems with FDLS: (4 Comments).

The FDLS will direct you to a problem component but will not tell you what is wrong.

It will tell the component is bad if it is a wire problem somewhere else. (2)

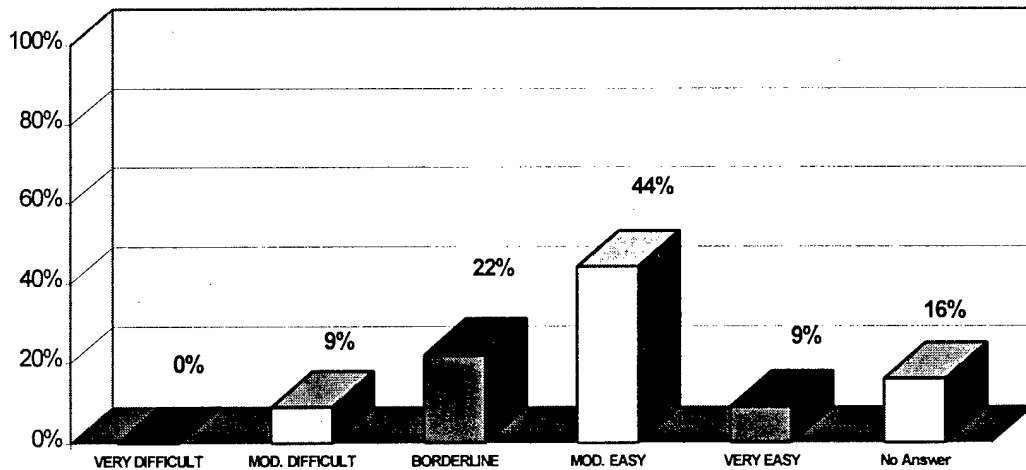
Even with the DTA, FDLS is not very helpful. (1)

Is moderately easy only when the problem is a LRU - not a wire, cannon plug, etc.

(1)



### 68N RESPONSES



### 68N Comments

#### Additional training needed. (4 Comments).

- At first it was hard, but after 200 times it becomes easier. (1)
- Had tech rep give me instructions. (1)
- FDLS is only easy for civilian tech - they get the training. (1)
- 70% don't know how to use (get lost). (1)

**TS5. When using other methods (besides FDLS) to troubleshoot components, what problems do you have?**

**List methods and problems:**

### 67R Comments:

#### Problems experienced with troubleshooting manuals: (23):

- Troubleshooting manuals very often don't cover the problem. (6)
- Vagueness of TM's, TM's unclear. (3)
- The technical manuals are incomplete. Several steps miss important sub-steps but list obvious steps that aren't necessary. (2)
- In TM's finding the correct fault that may apply to a situation. (2)
- Books are difficult to follow. (2)

Some troubleshooting procedures were in the TM55-series but got left out of TM-1 series. (1)

The book is not complete. The publisher left out important steps on the main rotor head from the 1985 issued book from the 1989 issued book. 1989 is the current book. (1)

Locating the component - sometimes the TM doesn't tell you where. (1)

Locating manuals. (1)

Maintenance manuals have a lot of mistakes. (1)

Being able to read wire diagrams. (1)

T-manuals tell you the problem, but don't go further in-depth. (1)

Not specific enough - need more in-depth info on the operation of major systems. (1)

Wiring diagrams are wrong. (1)

## **68X Comments**

### **Problems experienced with troubleshooting manuals: (25 Comments)**

Manuals are not updated to latest mods. (5)

Fault Isolation Procedure (FIP) charts are incomplete. (3)

Many times there is no FIP for the problem in any TM. (2)

TM's aren't clear enough. (2)

FIP charts - schematics are incorrect. (2)

Drawings are not always correct or show you every place it goes. (1)

TM sometimes doesn't list the fault. (1)

The FIP says to do something but nothing is wrong throughout the steps of the FIP. (1)

TM's lists wrong wire-to-wire segment. (1)

TM's never list problem we are troubleshooting. (1)

Troubleshooting manual does not go in-depth (schematics). (1)

The T10 manual should be set-up like a schematic and not a diagram. (1)

Put more resistive values in the TM's for end items. (1)

Changes are not getting to us. (1)

Manuals do not coincide with each other. (1)

TM 1-1520-238-23T-10 has several mistakes. (1)

### **Problems with connectors: (6 Comments)**

The Raychem connectors are very hard to deal with. Especially on the sides of the main power supply box behind the pilot. (1)

Have trouble finding correct pins and cannon plugs. They should be marked better. (1)

Rocket cannon plug connector pin. (1)

Wire chasing and getting to connectors behind seats. (1)

Connectors are in very hard to reach areas. Pin #'s are hard to read. (1)

Not being able to read labeling on terminal blocks and cannon plugs and Raychem

connectors. (1)

### **68N Comments**

#### **Problems experienced with troubleshooting manuals. (14 Comments)**

The TM's are not accurate. (3)

TM's have vague descriptions and are not specific. (2)

TM's (2)

The TM's Fault Isolation Procedures (FIPS) are not correct a lot of the time. If you don't have good troubleshooting skills, you can go off track due to the incorrect FIPS. (1)

Using theory of operation with schematics. It's a problem if the schematics are wrong. (1)

A lot of the time, the books are misleading or lead you down a bad path. The wires often go to the wrong place in the TM's. (1)

Wire diagrams and schematics are spread over several pages. (1)

Flow charts. (1)

TM's not updated with the correct diagrams or parts NSN. (1)

Wire schematics not matching the wiring. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**TS6. List any problems you have experienced while performing safing procedures on the aircraft prior to troubleshooting?**

### **67R Comments**

#### **Problems experienced while performing aircraft safing procedures: (5 Comments)**

Hydraulic pressures trapped after releasing pressure causing risk to mechanics and equipment in the immediate area. (1)

Fire extinguisher wiring diagram. (1)

Breaking BUCS pins. (1)

Need battery for troubleshooting. (1)

Ground receptacles by fwd and aft fuel cells - must remove receptacles to remove fuel cell because grounding cable gets stepped on and breaks. (1)

Note: Safing of the aircraft is performed by 67R personnel only.

**TS7. List any troubleshooting tasks that you perform at AVUM that you feel should be performed by another MOS?**

**67R Comments**

Tasks that should be performed by another MOS: (13 Comments).

Wire chasing (68X). (3)

Longitudinal servo act (68X). (2)

Engine problems (68B). (2)

Rotor smoothing, prop and rotor (68D). (2)

Temperature alarm test. We as 67R's aren't trained well in electronics. (1)

DASE computer malfunctions. (1)

APU troubleshooting. (1)

Installing shims on scissor assembly should be done by prop and rotor (68D). (1)

**68X Comments**

Pitot static troubleshooting: (9 Comments)

Pitot static test - 67R. (5)

Pitot static troubleshooting. (4)

Stabilator troubleshooting: (8 Comments)

Stabilator problems should be addressed by 67R. (6)

Stabilator troubleshooting. (2)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

## **68D Comments**

No significant comments.

**TS8. What are the most significant improvements that could be made to the AH-64 to reduce the time needed to troubleshoot components?**

**List improvements and amount of time you think it would reduce:**

## **67R Comments**

Improve accessibility to components: (8 Comments).

Make components easier to get to. (2)

Make all access panels with camlocks and camlock receptacles. (1)

Improve accessibility to catwalk area. (1)

Improve accessibility to transmission. (1)

Improve accessibility to lower flight controls (e.g., BUCS pins and LVDTs). (1)

Improve accessibility to ammo feed lines. (1)

Access hole for stabilator bolts head needs to be bigger. (1)

Improve design of aircraft components: (8 Comments).

Have a more improved caution warning panel system. It would save time. (1)

Simplify pressure filter bypass or separate it from the primary and secondary systems to simplify repairs without replacing the whole accumulator. (1)

A better or improved aircraft and component electrical harness. (1)

Need better transducers. (1)

Collective cover needs to be re-done. (1)

90 degree gearbox needs to be redesigned to a two-piece type. (1)

Make components that can handle more flight hrs. (1)

Reduce the number of black boxes and cannon plugs. 25% of problems are either loose or wet cannon plugs. (1)

Improve FDLS: (7 Comments).

FDLS needs to be more accurate on flagging correct components. (3)

Install more external BIT detectors on avionics. (1)

Install more external BIT detectors on weapons. (1)

Install more external BIT detectors on MUX black boxes. (1)

Update FDLS to keep run test through all components - would save at least one hour of troubleshooting. (1)

#### Improve Troubleshooting Manuals: (5 Comments)

Have an alphabetical order of all MOC's required, listed in each TM and also in the 23-series manual. (1)

Have a list of all symptoms of trouble, not just for FDLS or warning lights, but for mechanical system also. (1)

Increase TM info and an index of troubleshooting charts. (1)

Better detailed TMs.

Put more specific information in the T-2 manual. (1)

#### Improve Training: (5 Comments)

Crew chiefs need aircraft APU license. (1)

More experience in electrical portion of the aircraft. (1)

More experience in weapons portions of the aircraft. (1)

More use of break out boxes and qualify to use them. (1)

Properly trained electronics and armament personnel. (1)

#### 68X Comments

##### Provide better troubleshooting manuals: (18 Comments)

Bring back 55-1520-238-23-10. It had better wiring diagrams. Would save hours. (5)

Better schematics like the tech reps use. Would save hours. (2)

Update manuals. (2)

Make sure TM's are updated - 30 min. (2)

Better wiring diagrams - it would reduce amount of time by 20%. (1)

TM's that don't give conflicting results.

TM's need to contain more information.

The T10 manual should be set up like a schematic and not a diagram. (1)

Put more resistive values in the TM's for end items. (1)

Improve TM FIPS. (1)

Have a laptop computer with all the TM's in it. That way, all you would have to do to update changes is add them to your hard drive. Would save 10 hours a week. (1)

##### Improve the FDLS: (7 Comments).

Improved FDLS. (5)

Troubleshooting any systems connected to the MUX bus via an RT should first identify the failure as either a bus failure or actual component in a non-reporting status. (1)

Incorporate the DTA functions into the FDLS. Would save tremendous amount of time. (1)

Provide better access to components: (4 Comments).

Provide more working space on the aircraft - it would save hours. (2)

Larger access panels would speed maintenance over the whole aircraft. (1)

Extend the Fab door to include R & L 90 for MRTU type 1 - would save 30 minutes to one hour. (1)

#### **68N Comments**

APR 39 accessibility and improvements. (9 Comments)

Improve accessibility to APR-39 forward receiver. (4)

Put FWD APR-39 receiver behind FAB. TM method requires 4+ hours down time.

Moving it to a more accessible area would save hours. (3)

Stronger and better mount for aft APR-39 receiver the old kind cracks and must be removed. It would greatly reduce down-time.(1)

Relocate the forward and aft APR-39 receivers. It would save 3-6 hours weekly if they were in a more accessible location.(1)

FDLS improvements. (6 Comments).

More detailed FDLS results. (2)

A FDLS system that would indicate bad relays. (1)

A FDLS system that would indicate loss of power or ground. (1)

Better explanation for FDLS fault codes. (1)

FDLS needs to be more like the MUX page on the OH-58D.(1)

#### **68B Comments**

No significant comments.

#### **68D Comments**

No significant comments.

**TS9. If you have any other problems or comments relating to troubleshooting AH-64 components, please describe them here:**

#### **67R Comments**

Problems experienced with troubleshooting manuals: (4 Comments)

There is no list for troubleshooting any mechanical problem that is not part of the

FDLS.(1)

There is no list for troubleshooting any mechanical problem with a gauge or instrument.(1)

Some schematics are not detailed enough to show what is really going on. (1)

The T-manuals (troubleshooting) need to cover more problems that might be encountered. (1)

### **68X Comments**

#### **Problems experienced with troubleshooting manuals: (9 Comments)**

No theory of operation for performing aircraft boresight using CBHK. (2)

No enough information on FCC. Need more on how it works than what it does. (2)

List more problems in the T-S manuals. (2)

TADS FIP charts should be more clear. (1)

The charts on the IAT gates are cluttered. (1)

Troubleshooting manual leaves out some major problems we run into such as the 30mm gun slamming into the ground or gun vibrates a little in elevation. (1)

### **68N Comments**

#### **APR-39 improvements. (8 Comments)**

The location of the APR-39 forward receiver makes it very difficult to access. (4)

APR-39 receiver mount cracks often. (2)

Fwd receiver for APR-39 should be in one of the forward avionics bays. (1)

Make the APR-39 just one single unit. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

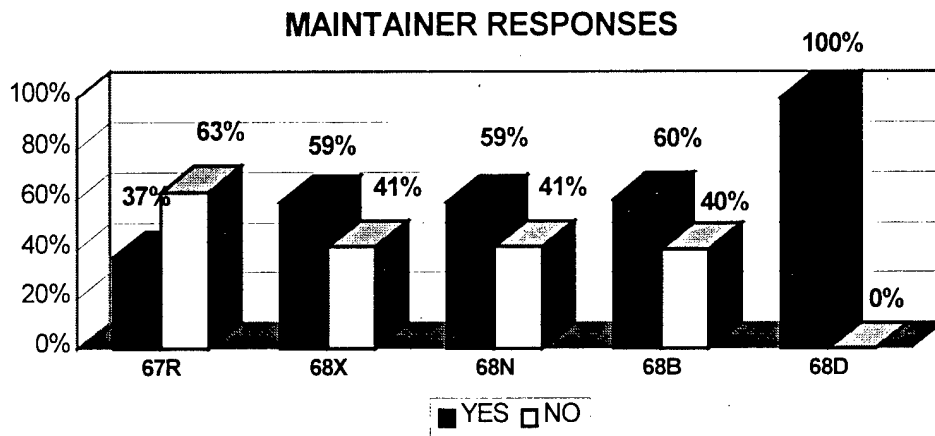
No significant comments.



## ACCESSIBILITY

**AC1. Are there an adequate number of access panels on the AH-64 for accessing components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list additional panels needed:**

### 67R Comments

#### Crewstation area: (10 Comments)

- SPADS - need access panel behind CPG seat. (3)
- Bottom - CPG and Pilot BUCS pins. (1)
- Bottom - CPG and Pilot LVDT's (linear variable differential transducer). (1)
- Easier access the BUCS switches. (1)
- Panel behind pilots seat to access servos easier. (1)
- SPADS accessibility. (1)
- Detonation cords. (1)
- Pilot and CPG door forward latch needs panel for easy removal. (1)

#### Environmental Control Unit (ENCU): (6 Comments)

- Panel needed between ENCU and #1 engine. (2)
- ENCU mount bolts. (2)
- ENCU. (2)

Tailrotor Gearbox: (4 Comments).

Tail rotor gear box needs door for easy access. (2)

Redesign overlaps around the tailrotor hub panels and reduce the number of fasteners.(1)

R540 needs to be revised. (1)

Transmission area: (4 Comments)

On the bottom of the XMSN deck to access to the bottom of the XMSN so we can get to the oil pumps on the bottom of the XMSN so we don't have to remove the XMSN (ammo bay).(2)

Need panel to access transmission diverter valves. (1)

R side and L side of XMSN bay. (1)

Tailboom area: (4 Comments)

Easier access to the tail boom area. ((2)

Need access panel and door on R545 for inspections. (1)

Panels are needed on the tailboom to perform proper inspection and maintenance. (1)

**68X Comments**

Access panel in L60 and R60: (9 Comments).

Access panel in L60 for accessing MRTU type I. (5)

Access panel in R60 for accessing MRTU type I. (4)

More accessibility above and around 30mm gun turret: (9 Comments)

Need more accessibility to the carrier drive system above and around the turret. (3)

The SPADS above the gun turret should be accessible without dropping the turret. (2)

Flex chute. (2)

SPADS. (1)

Enlarge hellhole. (1)

### **68N Comments**

#### **APR-39 access. (6 Comments)**

APR-39 forward receiver is pain in the ass to work with. (3)

Panel needed on underside of nose to access APR-39. Without removing the Aircraft Interface Assembly (AIA).

(2)

On top of vertical stabilator, needs to be easier access to repair position light and APR-39 aft receiver. (1)

#### **Transmission panels. (4 Comments)**

In the transmission area, need panel to access the air speed transducers. (3)

Need a guard for the #1 transmission panel when R&R-ing it. (1)

### **68B Comments**

#### **Need better access on bottom of engines. (3 Comments)**

Panels under engine need to be larger. (2)

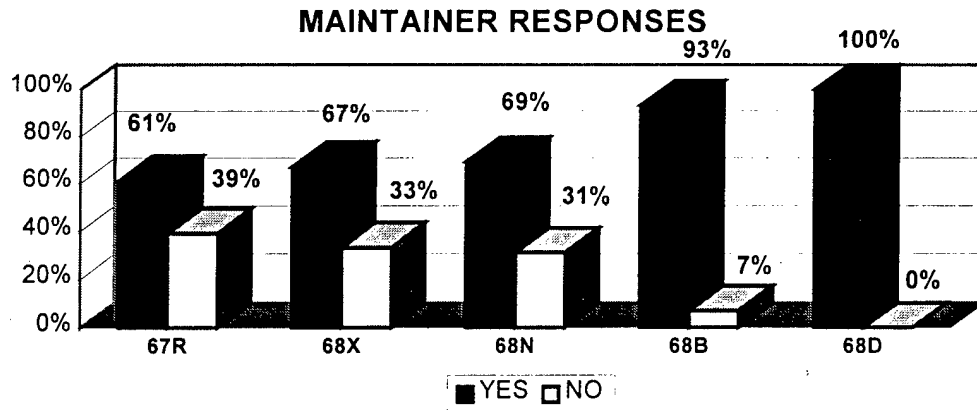
Add panel for aft bottom of engines. (1)

### **68D Comments**

No significant comments.

**AC2. Is the location of access panels on the aircraft adequate for accessing components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list panels and describe problems:**

**67R Comments**

**Crewstation Area: (8 Comments)**

BUCS pin for cyclic sticks. (3)

Need bigger access panel in the pilot station to gain more access in order to change directional SPAD pin without dropping the gun and turret. (2)

SPADS accessibility - dropping the turret to get to them really sucks. (2)

One behind 30mm turret for pilots directional controls. (1)

**Auxiliary Power Unit (APU): (4 Comments)**

Underside of APU. (2)

Door latches - should have small access panel to service APU oil. (1)

Panel to access right side APU. (1)

**Right and Left 200 panels: (4 Comments)**

Main transmission access doors should be vertically hinged just forward of center latches to swing out for easy removal and easy access without removing. (2)

L 200 and R 200 - not enough room. (1)

R 200 lower aft section - can't reach hydraulic lines. (1)

### 68X Comments

#### Wing stores panel: (5 Comments)

On wing stores remote control circuit breaker (RCCB) for outboard pylons. Difficult to remove. Move panel back and move RCCB away from edge of wing. (5)

### 68N Comments

No significant comments.

### 68B Comments

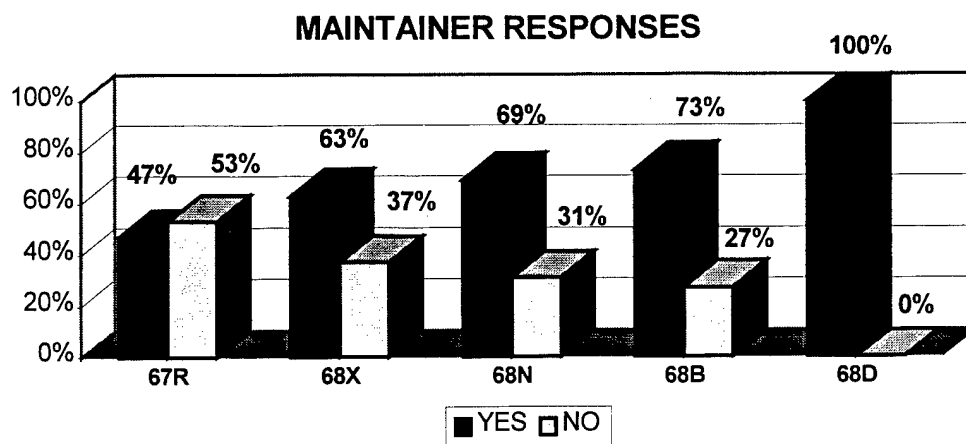
No significant comments.

### 68D Comments

No significant comments.

**AC3. Are the sizes of the access panel openings on the aircraft adequate to perform the required tasks?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list panels and describe problems:**

**67R Comments**

Horizontal Stabilator: (7 Comments).

Stabilator bolts access panel. (5)

The stabilator bolts access hold is too small if the VHF no. #1 antenna is too close to the stabilator. (1)

Stabilator panel for bolts in too small and should be rectangular. (1)

Fuel Cell Area: (4 Comments)

Fuel cell removal task. (1)

Most panels associated with fuel cell maintenance are very hard to remove and are usually too small. (1)

Fwd fuel cells aft mounting bolts access panel is too small. (1)

Larger fwd fuel cell access panels on the transmission deck. (1)

Transmission Area: (4 Comments)

Door used to access transmission inspection hole for oil level is too far back for straight viewing. (2)

Panel L-200 (bigger). (2)

**68X Comments**

No significant comments.

**68N Comments**

Improve APR-39 access. (4 Comments)

R578 too small (can't access APR-39). (2)

The panel on the front of the FAB's to access the APR-39 antenna needs to be twice the current size. (1)

Panel on tailboom to access APR-39 is too small. (1)

**68B Comments**

Need better access on bottom of engines. (4 Comments).

Panels under the engines need to be larger. (2)

ECU and DEC access panel needs to be 3" longer and 2" wider. (1)

Access panel below DEC unit. It is hard to get any testing equipment in to test the

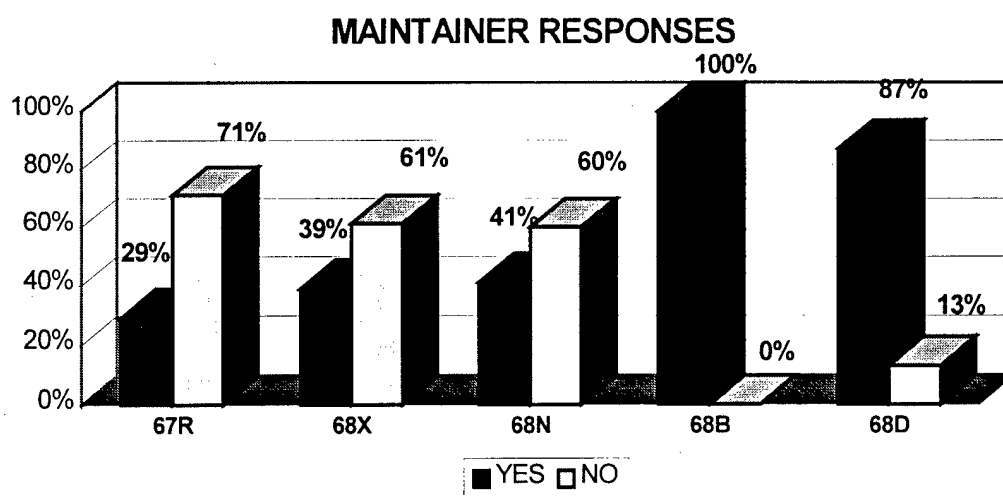
DEC unit. (1)

### 68D - Comments

No significant comments.

**AC4. Are access panels easy to open and remove?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list panels and describe problems:**

### 67R Comments

L540 panel (tail rotor gear box panel): (30 Comments)

L540 panel is difficult to remove and install. (8)

L540 panel tears up too easily. (3)

Tail rotor gearbox forward panel is very time consuming to remove and install - dreadful!!! (3)

Too many camlocks on the tail rotor gearbox cover. (3)

L540 too big (should be split). (2)

L540 dzus fasteners difficult to get at. (2)

L540 could be easier to take off. (2)

90 degree gearbox fairing. (2)

L540 tail rotor gearbox panel is odd-shaped and material is thin. (1)  
Use clasps instead of camlocks on L540. (1)  
Tail rotor GB panel is awkward and bends too much when putting on the panel, you usually hit parts of the tailrotor GB and surroundings. (1)  
Problems with dzus fastener on 90 degree gearbox fairing and IGB fairing. (1)  
L540 tabs next to directional bellcrank always break. (1)

#### Left and Right 200 panels: (10 Comments)

L200 panel binds in removal and reinstallation with exposed step-handhold. (4)  
Transmission cowling is sometimes difficult to install or remove. (2)  
L200 is difficult and tends to get scuffed a lot because of the step. (2)  
L and R 200 panel causes too much damage during re-installation due to the way the fasteners are on the panels. (1)  
On the #1 side of the transmission bay, the L200 panel is kind of hard to put in because of the step. It needs to be moved about 3" or shorten the step. (1)

#### T355 panel: (5 Comments)

T355 formation light needs quick release splice for removal. (2)  
T355. (1)  
T355. Need to be a cannon plug instead of soft splices so we can take the panel off without armament (68X) to replace wires that usually get broken in the process. (1)  
T355 wires to the formation light are always snapped off. (1)

#### Bottom panels: (5 Comments)

B200 requires 2 people. (2)  
B85R and B85L screws strip too easily. (1)  
B85L and B85R panels curve too far under Fab to get to screws. (1)  
Butt panels. (1)

#### Problems with access panel fasteners: (5 Comments)

Access panels with screws take too long to remove. (2)  
Take out screws and replace with bolts. (1)  
LW13 and RW13 screws strip too easily. (1)  
Fasteners wear out quickly and are a very real FOD problem. For example, we had a dzus fastener pop out of R540 and hit the inner tailrotor blade and shoot through the stabilator. Just think if it had shot 90 degrees to the front of the aircraft. (1)

#### 68X Comments

#### L90 and R90 panels: (18 Comments)



R90 panel has too many screws. Maybe use dzus fasteners instead. (4)

L90 panel has too many screws. Maybe use dzus fasteners instead. (4)

L90. (4)

R90. (4)

L90 has too many screws that are easily stripped out. (1)

R90 has too many screws that are easily stripped out. (1)

Bottom panels: (13 Comments).

B90 is tough to install and remove.(4)

B120 is tough to install and remove. (4)

B90 gets torn up because there is too much stuff around turret to get caught on. (2)

B120 get torn up because there is too much stuff around turret to get caught on.(2)

B105 is to close to drain ports. (1)

L60 and R60 panels: (4 Comments).

Panels covering the MRTU type 1's. (3)

L60 and R60. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**AC5. List any components where there is significant interference from surrounding components when servicing or removing and replacing?**

**List components and describe problems:**

**67R Comments**

ENCU. (30 Comments).

Applying safety on ENCU turbine plugs. (6)

ENCU lube oil filter. (5)

ENCU cooling turbine. (4)  
ENCU servicing plugs. (4)  
ENCU hard to remove and reinstall. (4)  
ENCU turbine plug. (3)  
ENCU mounting bolts. (3)  
The catwalk interferes with ENCU servicing. (1)

#### Auxiliary Power Unit (APU): (14 Comments)

APU oil level - have to take APU cover off to add oil. (4)  
APU tripod mount. (2)  
APU (2)  
PTO clutch - difficult to re-torque correctly (2)  
APU exhaust. (1)  
APU safeties. (1)  
APU drive shaft anti-fail. (1)  
APU - it is almost impossible to take an oil sample the proper way (through the chip detector). You can barely get your hands to the chip detector. (1)

#### Shaft Driven Compressor (SDC): (13 Comments)

SDC. (9)  
SDC hard to remove without touching driveshaft. (4)

#### Fuel System Components: (12 Comments)

Aft fuel boost pump is hard to reach. (5)  
Fuel cell mounting bolts. (2)  
To remove the aft fuel boost pump, you have to pry it out and usually end up damaging component. (2)  
Transfer fuel cross-over valve. Not enough room to reach in to remove screws. (1)  
#1 and #2 fuel valves. (1)  
Servos and transformer rectifier are in the way from getting to the forward fuel tank modification. (1)

#### Fire Bottles: (12 Comments)

Fire bottles. (12)

#### Crewstation Areas: (9 Comments)

CPG lateral SPAD (shear pin activated decoupler). (3)  
The access panel behind the pilots seat is somewhat hard to get to after the seat is tilted forward. (1)  
APR-39 in copilot's seat. (1)

BUCS pin. (1)

LVDT. (1)

Transparent blast shield - it takes you two working days because you have to remove too many components. (1)

Collective servo rod end is almost impossible to torque. (1)

#### Gearbox Components: (8 Comments)

Accessory gearbox filter. (2)

Applying safety on accessory oil pump near right rear of transmission. (2)

Removal of fan shroud on the 42 degree gearbox. (1)

Accessory pump. (1)

Tail rotor gearbox temp sensors behind L595 should be mounted horizontally. (1)

Nose gearbox - sometimes they don't seat properly. (1)

#### Hydraulic System: (7 Comments)

Hydraulic pumps. (4)

Utility hydraulics. (3)

#### Servo-Cylinders: (6 Comments)

Servo-cylinders. (5)

Main rotor servos. (1)

#### Driveshafts: (6 Comments)

Catwalk and driveshaft removal. (2)

The driveshaft must be removed with caution not to dent the driveshaft. (1)

Screws are hard to get to on the driveshaft guide. (1)

Driveshaft #4. (1)

Driveshaft #7. (1)

#### 68X Comments

#### TADS-PNVS compartment components: (19 Comments)

PNVS cannon plug. (4)

TADS due to ECS cannon plug. (3)

PNVS cannon plug does not have enough room to get hand in to take it off. (2)

PNVS cannon plug through gimbal to take PNVS off. (1)

PNVS grounding strap. (1)

PNVS Electronic Control Amplifier (PECA) is hard to get to. (1)

Difficult to get Allen socket on laser transceiver. (1)

Difficult to get Allen socket on boresight assembly. (1)

TADS Electronic Control Amplifier (TECA) (TADS shrouds in the way). (1)  
Boresight module. (1)  
Components in the Aircraft Interface Assembly (AIA) are too close together. (1)  
ECS filter. (1)  
ECS. (1)

Air data processor: (9 Comments)

Air data processor (ADP).(6)  
ADP - you have to remove 3 different LRU's just to replace it. (2)  
Air data processor is hard to reach and easy to lose its mounting hardware. (1)

30mm gun ammunition system: (6 Comments)

Flex chute. (2)  
Rails for the AWS system. (1)  
Interior panels hiding the AWS rails are really not needed. (1)  
Ammo box. (1)  
Carrier drive - confined space. (1)

DASE computer. (4 Comments)

DASEC. (4)

Optical relay tube (ORT) Components: (5 Comments).

ORT. (2)  
Crash link and wire covers on ORT column. (1)  
Optical relay column. (1)  
Indirect View Display (IVD). (1)

**68N Comments**

APR-39 Components. (18 Comments).

Forward APR-39A receiver. (8)  
Forward APR-39 receiver. Interference from the ORT, pedals and cyclic stick and TADS. (4)  
Front APR-39 receiver is in a totally ridiculous location. (3)  
BUCS gets in the way of APR-39 receiver. (1)  
Have to be a contortionist to access forward APR-39 receiver from the CPG seat. (1)  
Have to remove Aircraft Interface Assembly (AIA) to get to APR-39 forward receiver. (1)

HARS. (7 Comments)

HARS (6)

HARS - not enough room to reach the back right screw. (1)

68B Comments

IPS blower. (4 Comments)

IPS blower and shroud inlet. The back 2 nuts are almost impossible to reach. (2)

5th nut on IPS blower is too far up in the back and hard to get to. (1)

The fuel filter on the accessory gearbox is always in the way to get to the nuts on the IPS inlet duct. (1)

G-Axis. (3 Comments).

Removing the G-Axis fifth nut. (2)

G-Axis seal. (1)

68D Comments

No significant comments.

**AC6. List any components where you do not have sufficient workspace to easily service, remove and replace the component?**

**List components and describe problems:**

67R Comments

Environmental Control Unit (ENCU): (28 Comments)

ENCU. (8)

ENCU lubrication. (7)

ENCU cooling turbine.(7)

Applying safety on ENCU turbine plugs.(4)

ENCU safeties. (2)

#### APU Compartment and Components: (19 Comments)

APU. (4)  
APU safety on mounting bolts. (4)  
PTO clutch (APU). (3)  
APU compartment - just don't have enough space to work and clean the aircraft properly. (2)  
APU mounts. (2)  
Fuel line underneath APU. (1)  
APU Fuel boost press switch - too many lines in the way. (1)  
APU driveshaft anti-flail bearing. (1)  
APU oil samples. (1)

#### Crewstation compartment: (12 Comments)

Sometimes you can't even remove the SPAD because of the way it is situated. (4)  
BUCS switches. (3)  
SPADS (2)  
LVDTs - sometimes you can't even remove the SPAD. (1)  
Cockpits (1)  
Removing seats (1)

#### Fuel system Components: (9 Comments)

Fuel boost pump. (2)  
Fuel cells. (2)  
Signal conditions for fuel quantity. (1)  
Hard to install top vents and panels on the forward fuel cell. (1)  
Problem to gain access to aft fuel cell. (1)  
Transfer fuel cross-over valve. (1)  
Fuel transfer pump. (1)

#### Fire Extinguisher Bottles: (8 Comments)

Fire extinguisher bottles. (8)

#### Gearbox components: (7 Comments)

Accessory gearbox filter. (2)  
Accessory gearbox (1)  
To do an oil sample on the nose gearbox's. (1)  
Accessory gearbox pressure switch safety. (1)  
If the 2 back screws on the diffuser on the nose gearbox get stripped out you have to remove the gear box to drill them out. (1)

90 degree GB service plug has no room around it for tools. (1)

Hydraulic System Components: (7 Comments)

Primary hydraulic pumps. (2)  
Utility hydraulic pumps. (2)  
Hydraulic manifold bypass indicators. (1)  
Primary hydraulic manifold. (1)  
Emergency accumulator hydraulic lines.

Horizontal Stabilator: (7 Comments)

Stabilator mount bolts. (4)  
Stabilator transducer. (1)  
Stabilator covers. (1)  
Stabilator pivot bolts. (1)

Transmission Compartment Components (6 comments)

Transmission. (4)  
Transmission oil pressure switch. (1)  
Applying safety on accessory oil pump. (1)

Catwalk Area. (4 comments)

Catwalk is tight. (3)  
Catwalk area. (1)

Main Rotor System Components (4 comments)

Main rotor head. (2)  
Main rotor de-ice controller box when working on or replacing flight control hydraulic servo-cylinders. (1)  
Main rotor servo's. (1)

Servo Cylinders: (4 Comments)

Servo cylinders. (2)  
Servos. (2)

Cotter Pins: (4 Comments)

Torque link cotter pin. (1)  
Collective cotter pins. (1)  
Longitudinal cotter pins. (1)

Lateral cotter pins. (1)

### **68X Comments**

#### **30mm gun ammunition system components: (16 Comments)**

Flex chute. (8)

Feed chutes to turret (small opening where turret mounts). (3)

Having to drop the turret to replace the forward flex chute. (2)

Forward roller chutes. (1)

Ammo box. (1)

Carrier drive. (1)

#### **TADS-PNVS Compartment Components: (20 Comments)**

TADS ECS motor. (3)

The PNVS and Aircraft Interface Assembly (AIA) make removal and installation of the ECS cannon plug difficult. (2)

PNVS cannon plug through gimbal to take PNVS off. (2)

PNVS. (2)

PNVS cannon plug does not have enough room to get hand into take it off. (1)

TADS Electronic Control Amplifier (TECA). (1)

Boresight module. (1)

PNVS Electronic Control Amplifier (PECA) (turret hole). (1)

Indirect View Display (IVD). (1)

Aircraft Interface Assembly (AIA). (1)

ECS. (1)

ECS - to remove the cannon plug, you have to have very small fingers or find someone who does because of its location. (1)

ECS filter. (1)

ECS blower. (1)

#### **Optical Relay Tube (ORT) Components: (8 Comments)**

Left snubber pad on ORT. (3)

ORT. (2)

ORT doesn't have sufficient workspace. (1)

ORT Crash link. (1)

Wire covers on ORT column. (1)



## **68N Comments**

### **APR-39. (28 Comments).**

Forward APR-39 receiver. (19)

Rear APR-39 receiver. (6)

Rear APR-39 receiver. Sometimes your hands get cut around the panel opening. (1)

APR-39 processor for tightening bolts. (1)

Front APR-39 receiver, at CPG pedals, especially in a BUCS equipped AH-64. (1)

### **HARS. (5 Comments).**

HARS. (3)

HARS - other components are installed too close to allow adequate space for tools and hands. (1)

HARS - not enough room on right-hand side. (1)

### **Signal data converter. (4 Comments)**

SDC for Doppler. (2)

Signal data converter is hard to remove and reinstall. (2)

## **68B Comments**

### **G-Axis. (3 Comments).**

Removing the G-Axis 5th nut. (1)

Not enough room between #2 G-Axis and firewall. (1)

G-Axis seal. (1)

## **68D Comments**

No significant comments.

**AC7. List any components which require a significant amount of time to access due to interference from other components?**

**List components and time needed to access:**

**67R Comments**

Crewstation compartment: (19 Comments)

Pilot Directional BUCS Pin 2 hr (prep gun). (4)  
SPAD spin for collective and cyclic. (4)  
Det cord running to handle in CPG station. (3)  
Canopy doors - when replacing the door cable, you have to remove the entire window because one screw is blocked by a canopy jettison system component that could easily be removed. (2)  
Transparent blast shield takes two people and eight hours. (2)  
Transparent blast shield. (1)  
Collective. (1)  
Pilot electrical compartment. (1)  
LVDT. (1)

Fuel System Components: (16 Comments)

Fuel cell area. (6)  
Aft boost pump cartridge is time-consuming and dangerous - Several times the check valve sticks open causing extremely dangerous fuel leaks - local requirements to defuel aircraft mandated or TM not clear enough to emphasize this pre-condition. (3)  
Aft fuel cell. (3)  
Aux fuel lines in external wing. (2)  
#2 Fuel valve - can't get socket to get off fire wall. (1)  
Installing vent tube and cover on forward fuel cell. (1)

Environmental Control Unit: (10 Comments)

ENCU lubrication. (2)  
ENCU removal. (2)  
ENCU cooling turbine. (2)  
ENCU. (2)  
Applying safety on ENCU turbine plugs. (1)  
ENCU drain plus for safety wire takes 1.5 to 2 hours to safety. (1)

Fire Extinguisher Bottles: (7 Comments)

Fire extinguisher bottles are blocked by the ENCU. (7)

Auxiliary Power Unit: (7 Comments)

APU. (3)

Anti-flail on the APU driveshaft. (2)

PTO clutch on APU. (2)

Transmission Compartment: (7 Comments)

Transmission. (3)

Transmission oil filter. (2)

Applying safety on accessory oil pump near right rear of transmission. (1)

Removal of XMSN oil pumps 3 hrs (removal of XMSN). (1)

Engine Components: (7 Comments)

Primary exhaust - 2 hours. (3)

Engine Fire louvers. (2)

Engine exhaust nozzle (have to remove entire engine to remove it).(2)

Gearbox components: (5 Comments)

Accessory gearbox filter. (2)

Tail rotor gearbox panel is very hard to remove and reinstall. (1)

Accessory gearbox pressure switch for safing. (1)

Gearbox filter. (1)

Shaft Driven Compressor (SDC): (5 Comments)

Shaft driven compressor (SDC).(5)

Driveshaft Components (4 Comments)

#7 driveshaft. (2)

Driveshaft. (1)

Driveshaft #3. (1)

Main Rotor System Components: (4 Comments)

Main rotor servo's. (2)

Main rotor head. (1)

Strap pack. (1)

## **68X Comments**

### **30mm gun and ammunition system components: (15 Comments).**

Roller chutes. (3)  
All components involving 30mm cannon. (2)  
Forward flex chute - 45 min to access. (2)  
Aft flex chute - 45 min to access. (2)  
Carrier drive assembly - 15 minutes. (2)  
Forward flex chute - 1 hour to access. (1)  
Left twist chute. (1)  
Right twist chute. (1)  
Recoil adapter. (1)

### **TADS-PNVS Compartment Components. (12 Comments)**

PNVS cannon plug. (3)  
PNVS Electronic Control Amplifier (PECA). (2)  
PNVS. (2)  
Boresight module. (1)  
ECS fan on the Aircraft Interface Assembly (AIA). (1)  
TADS air filter. (1)  
Dayside. (1)  
Nightside clamps. (1)

### **Air data processor. (11 Comments).**

Air data processor (ADP). (7)  
Air data processor is behind 4 radios. Takes 30 minutes to access. (3)  
ADP is hard to reach and easy to lose its mounting hardware. (1)

## **68N Comments**

### **APR-39. (27 Comments).**

Forward APR-39 receiver. (18)  
Aft APR-39 receiver-antenna. (6)  
APR-39 forward receiver - 1 hour. (1)  
APR-39 forward receiver - if done correctly, the 68X takes at least 6 hours to remove the boresight. (1)  
APR-39 forward receiver - takes one day to access. (1)

HARS. (6 Comments).

HARS.(6)

Doppler (4 Comments)

Signal data converter. (4)

### **68B Comments**

G-Axis Seal. (3 Comments).

G-Axis Seal. (2)

5th nut on G-Axis seal. (1)

### **68D Comments**

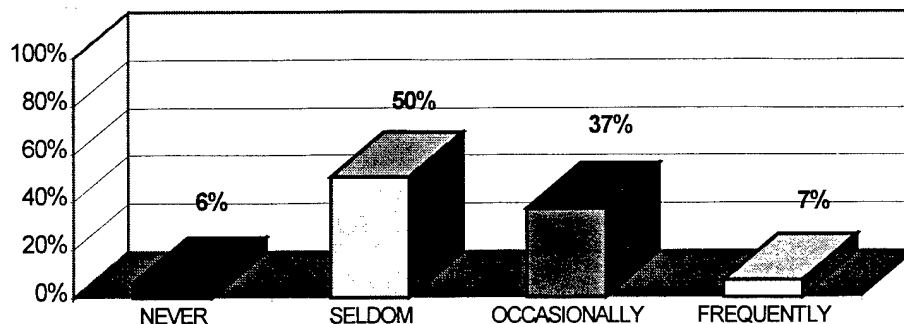
Generator drive shaft adapter - potential safety problem. (1 Comment)

Generator drive shaft adapter - make that a shear type at certain limited torque - after time in service, oil and heat causes plastic to seize in shaft; must be chiseled to remove, possibly causing FOD and shaft cork damage. (1)

**AC8. How often do components get damaged because of difficult access to a particular component? (Check one)**

Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_

**67R RESPONSES**



## **List components:**

### **67R Comments**

#### **Driveshaft: (15 Comments)**

Driveshafts . (5)

#7 driveshaft when removing driveshaft or PTO clutch. (3)

#4 driveshaft when removing SDC. (3)

Chip off paint on driveshaft because of SDC removal, even if you use rags or packing. (2)

#3 driveshaft gets scratched or nicked. (2)

#### **Airframe Panels: (7 Comments)**

L-200 panel. (2)

Tail rotor gearbox cover and associated airframe. (1)

Avionics bay door near pilots step when the avionics bay door is left open. (1)

90 degree gearbox cover breaks. (1)

L-250R. (1)

nose gearbox cover. (1)

#### **Crewstation compartment: (5 Comments)**

Detonation cords. (2)

SPADS. (1)

Door latches-locks. (1)

Seats. (1)

#### **Hydraulic System Components: (5 Comments)**

Hydraulic lines. (3)

#2 RHS rectifier - bend or break hydraulic lines. (1)

Hand pump area. (1)

#### **Transmission: (4 Comments)**

Transmission mounts. (2)

Transmission support mounts with hydraulic servo's. (1)

Transmission. (1)

#### **EMI Tape and Seals: (4 Comments)**

EMI tape around transmission access panels and airframe. (2)

EMI tape. (1)

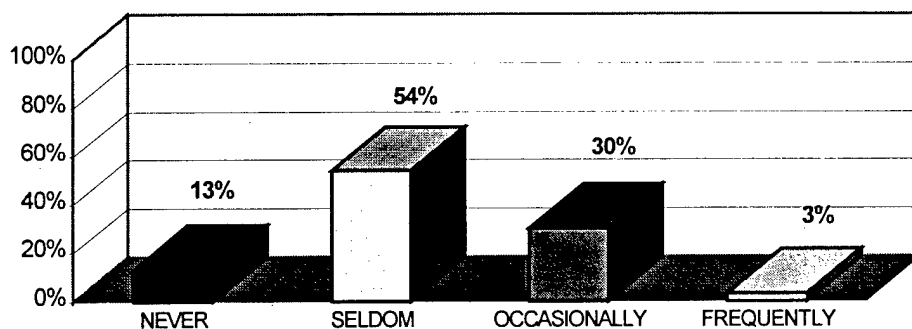
EMI seals on FAB compartments. (1)

Auxiliary Power Unit (APU): (4 Comments)

APU. (3)

APU driveshaft. (1)

**68X RESPONSES**



**68X Comments**

Optical Relay Tube (ORT) Components. (8 Comments)

ORT. (4)

ORT - the opening isn't wide enough. Need to make it wider (1/8 - 1/2") and if need be, snubber pads can be used to secure in place. (3)

ORT crash link. (1)

TADS-PNVS components. (6 Comments)

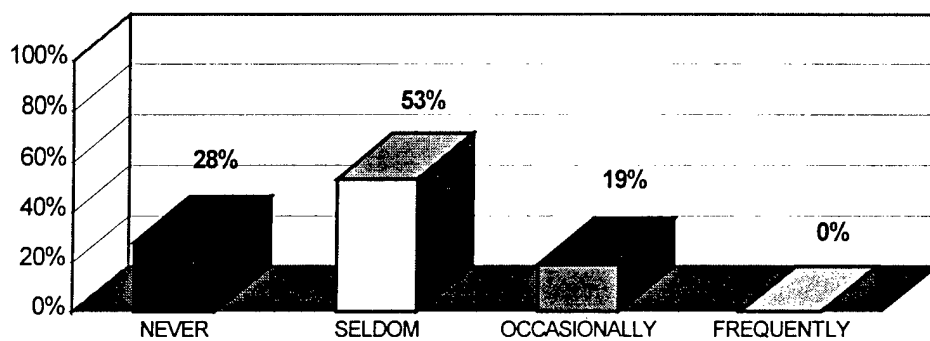
PNVS cannon plug. (3)

The PNVS connector to the Aircraft Interface Assembly (AIA) gets its pins damaged, not from difficult access, but because it is a bad way for a connector like that to have those pins. The connector should be a regular cannon plug. (1)

PNVS Electronic Control Amplifier (PECA). (1)

Nightside and Dayside from removing shroud.(1)

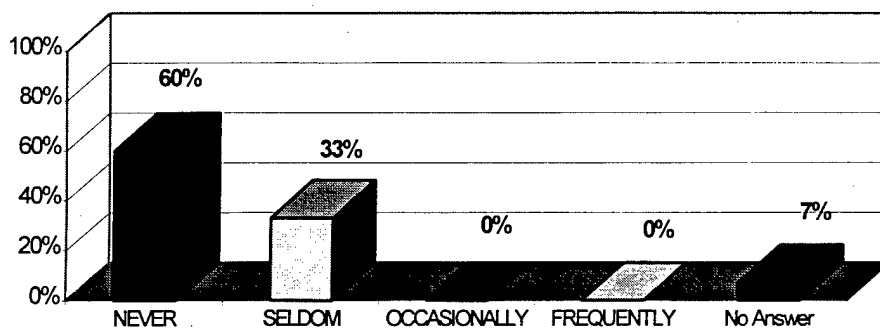
### 68N RESPONSES



### 68N Comments

No significant comments.

### 68B RESPONSES

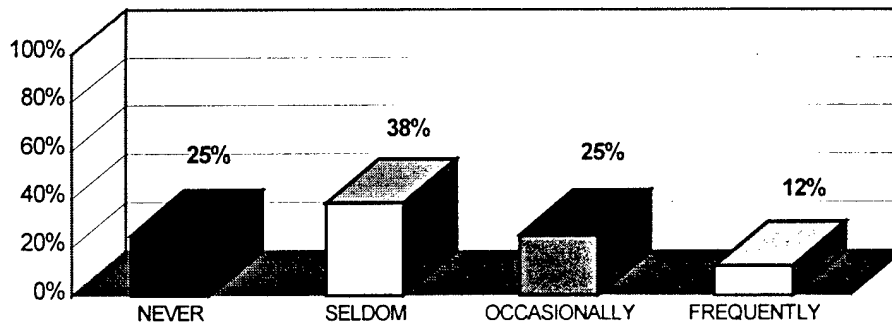


### 68B Comments

No significant comments.



### 68D RESPONSES



### 68D Comments

#### Driveshafts. (3 Comments)

#7 driveshaft (APU). (1)  
 Driveshaft flanges. (1)  
 Driveshafts. (1)

**AC9. List any components that are mounted on the aircraft in an awkward position making access difficult?**

**List components & describe problems:**

### 67R Comments

#### Gearbox Components. (17 Comments)

Transmission accessory gearbox switch assembly. (5)  
 Transmission accessory gearbox filter. (5)  
 Accessory gearbox pump on transmission. (2)  
 Transmission accessory gearbox. (2)  
 Tail rotor gearbox filler cap. (2)  
 Oil pressure transducers on the nose gearbox. (1)

#### Environmental Control Unit: (16 Comments)

ENCU. (4)  
 ENCU cooling turbine. (3)  
 ENCU bottom plug. (3)

ENCU cooling turbine - located almost directly under ENCU. (2)  
ENCU safety. (2)  
ENCU turbine bolts (top and bottom) are hard to get to. (1)  
ENCU removal mount bolt. (1)

Crewstation Compartment: (13 Comments)

SPAD pins (shear pin activated decoupler). (3)  
Det cords. (3)  
LVDT's (linear variable differential transducer). (2)  
Pilot and CPG seat pins. (2)  
Severance devices. (1)  
Explosive cartridges. (1)  
Door latches-locks. (1)

Fire Extinguishment System Components: (9 Comments)

Fire bottles. (6)  
Fire extinguishing system. (1)  
Engine fire louvers. (1)  
Squib cartridges. (1)

Shaft Driven Compressor (SDC): (7 Comments)

SDC - makes it hard to R&R. (7)

Auxiliary Power Unit (APU): (7 Comments)

APU forward right mount (safety). (3)  
APU. (2)  
Adding oil to APU can be messy - put an access door on the APU cover. (1)  
APU deck mounts - not sufficient room to get required tools and hand makes it very time-consuming and difficult to R&R. (1)

Hydraulic System Components: (6 Comments)

Hydraulic pumps. (3)  
Primary hydraulic pump. (2)  
Utility hydraulic pump. (1)

Fuel System Components: (5 Comments)

Fuel boost pump located behind panel in aft avionics bay. (2)

Fuel cross feed valve. (2)

Fwd fuel cell aft mounting bolts - takes way too long to get the pro-seal off and you become a contortionist. (1)

68X Comments

TADS-PNVS Compartment Components. (10 Components).

PNVS cannon plug. (3)

P1-J3 on the ECS assembly. (3)

The ECS fan on the Aircraft Interface Assembly (AIA). (1)

PNVS Electronic Control Amplifier (PECA). (1)

TADS Electronic Control Amplifier (TECA). (1)

TADS ECS motor. (1)

30mm gun and ammunition system Components. (8 Comments).

Carrier drive. (3)

Forward flex chute. (1)

The gun turret shield on the inside of the turret. (1)

Wire strike for the gun makes it hard to remove and replace the gun. (1)

Rails in the turret holes. (1)

Carrier drive assembly. (1)

Air Data Processor. (6 Comments).

Air data processor (ADP). (4)

Have to remove HARS to get to ADP. (2)

CPG Display Adjustment Panel (DAP). (4 Comments).

CPG DAP - seat interferes with removal. (2)

CPG DAP. Space is insufficient. (2)

Anti-Collision Light Power Supply. (4 Comments).

Anti-collision light power supply. Access to its mounting hardware and weight of components. (3)

Anti-collision light power supply. (1)

### **68N Comments**

#### **APR-39. (25 Comments).**

Forward APR-39 receiver. (have to get upside down in front seat or remove TADS). (17)

Rear APR-39 receiver. (7)

APR-39 processor. (1)

#### **HARS. (3 Comments)**

HARS.(2)

HARS electronic unit should be turned 90 degrees to allow easy access to adjust screw on side next to rear wall of aft avionics bay. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**AC10. For which components do you have a problem performing blind adjustments (e.g., mirrors, lights) when servicing or removing and replacing?**

**List components & blind adjustments:**

### **67R Comments**

#### **Environmental Control Unit (ENCU) Components: (25 Comments)**

Safetying the ENCU service plugs. (8)

ENCU lubrication. (5)

ENCU cooling turbine safety. (5)

Getting torque to the ENCU mount bolts. (4)

ENCU. (2)

ENCU mounts - Pro seal on forward 2 mounts is very difficult to do. (1)

#### Auxiliary Power Unit Components: (15 Comments)

APU. (5)  
APU forward mount safeties. (4)  
APU PTO clutch. (3)  
APU inboard mount bolt. (2)  
APU mounts. (1)

#### Gearbox Components: (6 Comments)

Accessory gearbox filter - need mirror and flashlight. (2)  
Transmission accessory gearbox filter and switch assembly. (1)  
Accessory gearbox oil pressure switch. (1)  
Accessory gearbox safety switch. (1)  
Accessory lube pump filter safety. (1)

#### Fuel System Components: (5 Comments)

Vents to forward fuel cell by the main rotor servo's and installation of frangible clips in this area. (1)  
Forward fuel cell. (1)  
Bolts in the top of the forward fuel cell (transmission area). (1)  
Fuel open port nozzle lanyard removal. (1)  
Fuel control valve - removing and replacing is done almost blindly. (1)

#### 68X Comments

##### 30mm gun components. (5 Comments).

Azimuth resolver adjustment on gun turret while mounted in aircraft. (4)  
Transfer housing for gun - hard to see timing marks. (1)

#### 68N Comments

##### Radar altimeter. (12 Comments).

Adjusting analog and digital screws on radar altimeter receiver-transmitter. (7)  
Adjusting radar altimeter remote receiver. (4)  
Radar altimeter digital display impedance matching amps. (1)

##### APR-39. (8 Comments).

APR-39 forward receiver. (4)  
Installing aft APR-39 receiver. (2)

Aft right connector on forward APR-39. (1)  
Screw on aft APR-39. (1)

#### **68B Comments**

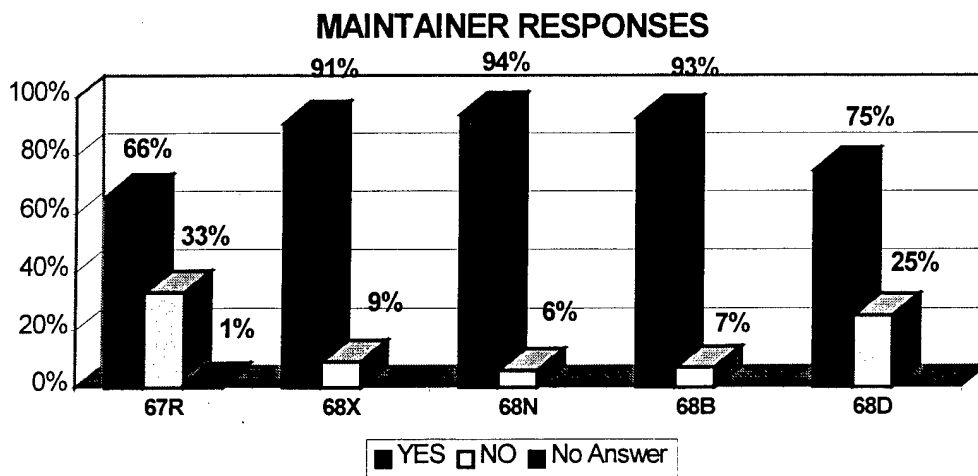
No significant comments.

#### **68D Comments**

No significant comments.

**AC11. Are footholds and handholds on the aircraft adequate for accessing components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list additional maintenance stands and where they are needed:**

#### **67R Comments**

Handholds-footholds needed on right side of aircraft: (11 Comments).

On the right hand (RH) side, there should be footholds to climb to the top of the cockpit like the left hand (LH) side has. (5)

Steps needed on right side of aircraft to access main rotor head. (3)

Need steps or platform forward of the nose gearbox and on right side for maintenance on rotor head. (2)

A foothold aft of the pilots door is needed to access the rotor blade and head area from the right side of the aircraft. (1)

Aircraft tail: (7 Comments)

Additional footholds could be used on vertical fin. (2)

Tail rotor gearbox. (2)

Put another handhold on the right of the tail step for balance. (1)

On the tail. I see people constantly standing on the horizontal stabilator. (1)

Need more on empennage. (1)

Catwalk area: (4 Comments)

The catwalk handhold is pretty weak. (1)

Steps up to catwalk are positioned awkwardly to up and down. (1)

Catwalk area is a nightmare. (1)

Catwalk access door behind #1 engine should fold back instead of over. (1)

68X Comments

No significant comments.

68N Comments

No significant comments.

68B Comments

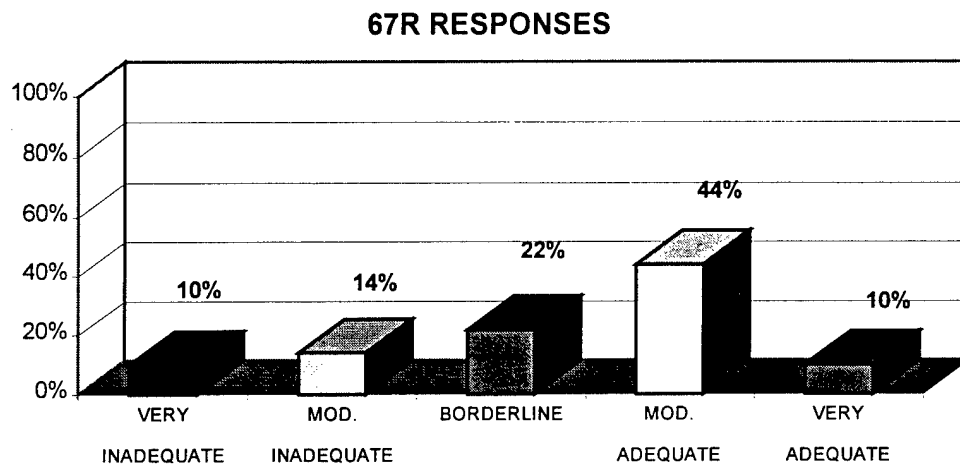
No significant comments.

68D Comments

No significant comments.

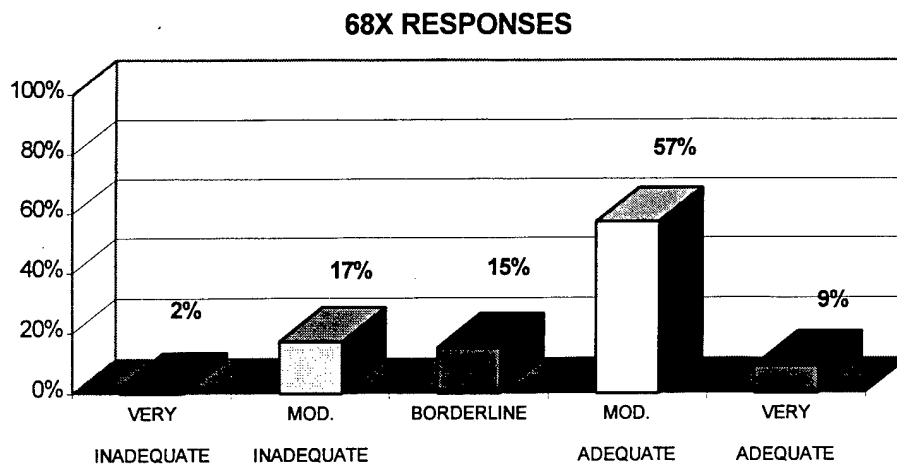
**AC12. Rate the adequacy of the maintenance stands provided to you for servicing and removing-replacing components. (Circle one)**

5	4	3	2	1
Very Inadequate	Moderately Inadequate	Borderline	Moderately Adequate	Very Adequate



### **67R Comments**

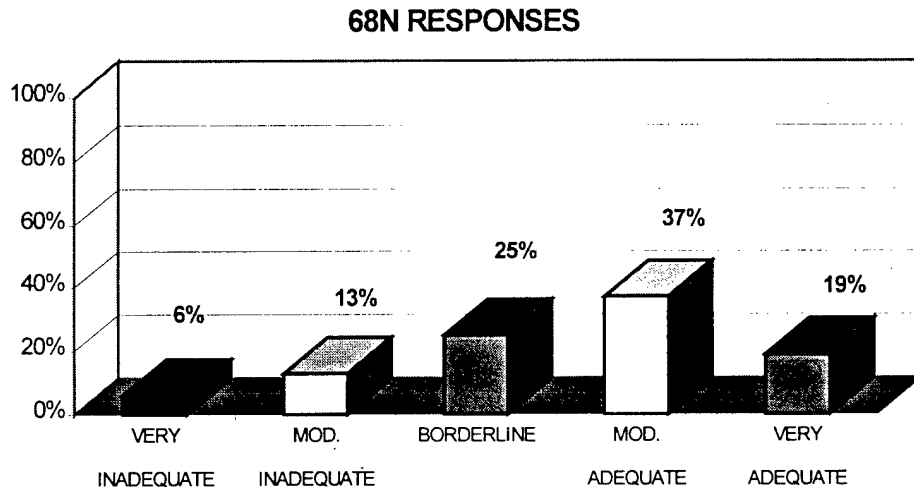
No significant comments.





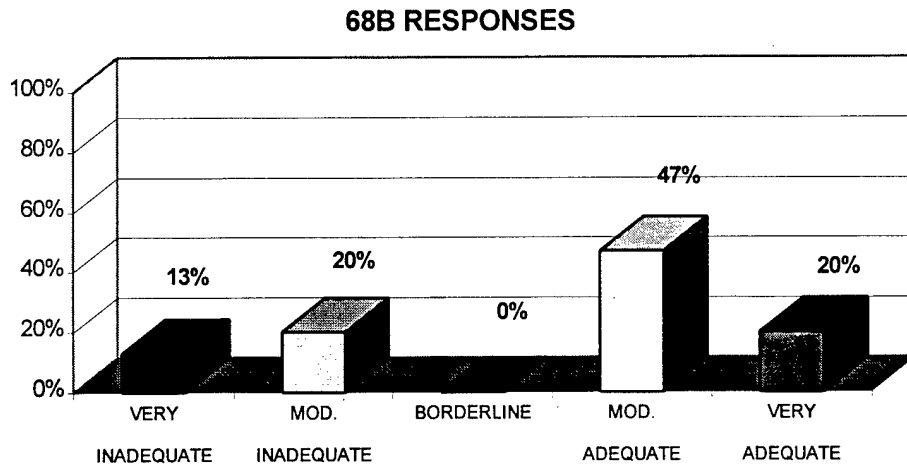
### 68X Comments

No significant comments.



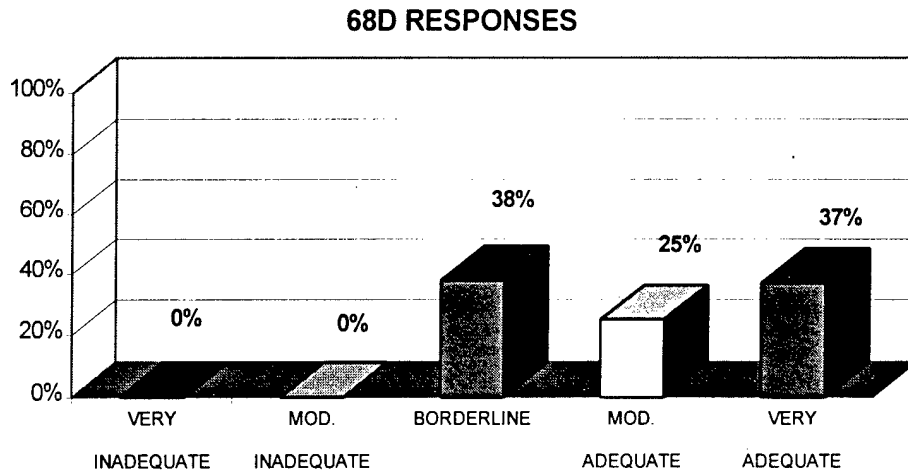
### 68N Comments

No significant comments.



### 68B Comments

No significant comments.

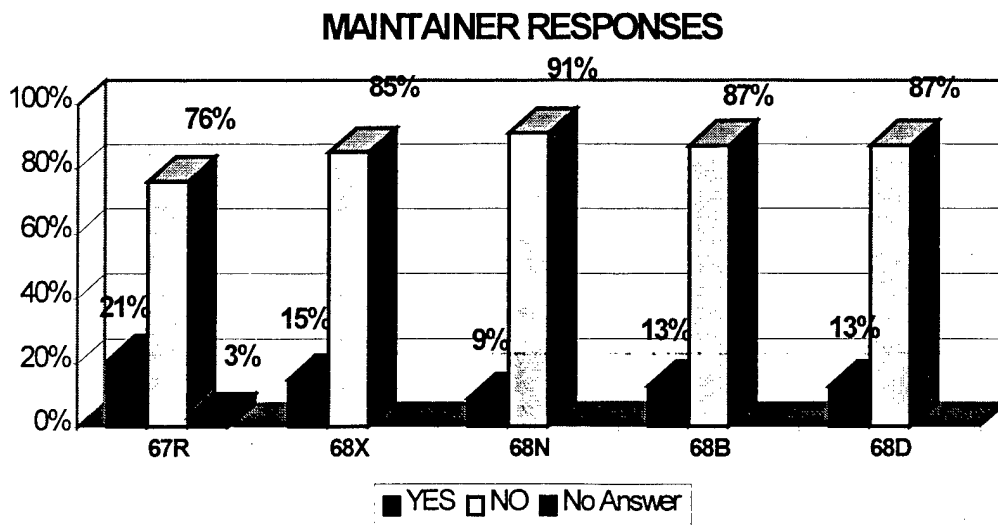


#### **68D Comments**

No significant comments.

**AC13. Are there any maintenance stands needed for servicing and removing-replacing components that are not provided to you at AVUM?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list additional maintenance stands and where they are needed:**

#### **67R Comments**

Maintenance stands needed for servicing main rotor or tail rotor: (4 Comments)

I believe that they should have a maintenance stand that is adjustable in height like the B-1 or B-4 that you can adapt a beam with a hand winch to remove tail rotor gearbox or tail rotor head or other heavy parts (TM 1-1500-204-23-9 - pg's. 9-25 for B-1 stand - pg's. 9-24 for B-4 stand). (1)

It would be nice to have a tail rotor stand that fit up around the empennage. (1)

Aft of main rotor . (1)

Hydraulic lift to work on tail rotor head assembly. (1)

#### **68X Comments**

No significant comments.

#### **68N Comments**

No significant comments.

#### **68B Comments**

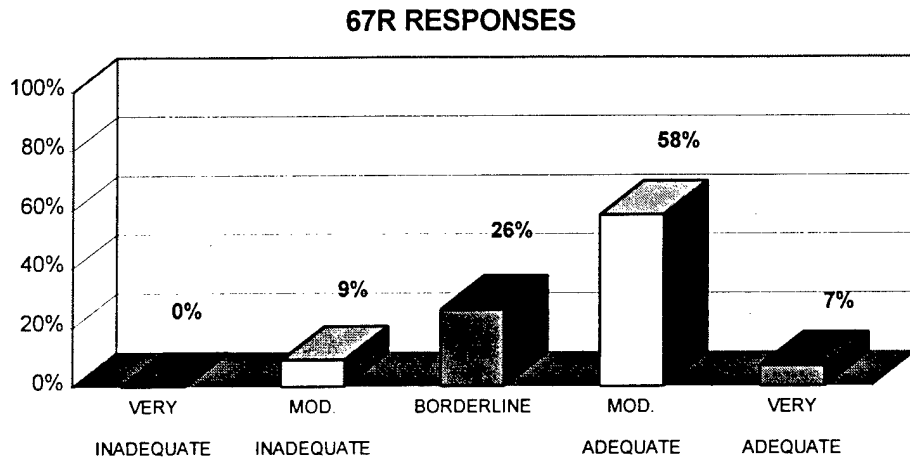
No significant comments.

### 68D Comments

No significant comments.

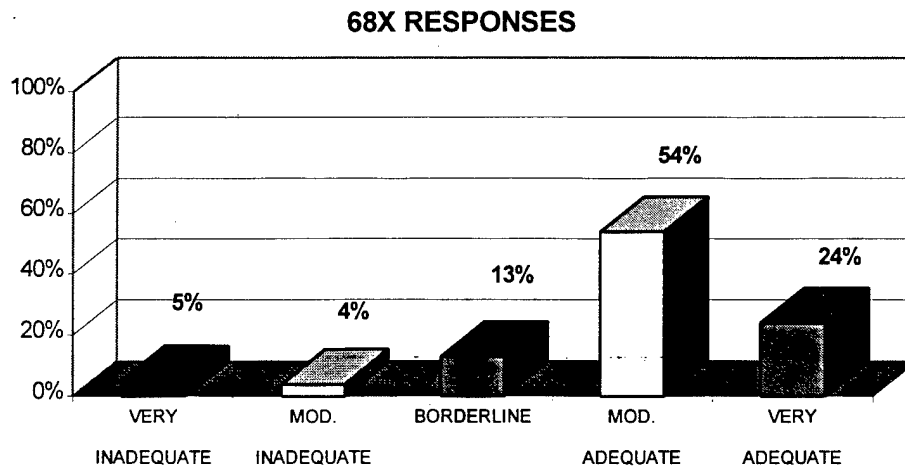
**AC14. Rate the adequacy of the integral work platforms (e.g., catwalk, doghouse) provided to you for servicing and removing-replacing components. (Circle one)**

5	4	3	2	1
Very Inadequate	Moderately Inadequate	Borderline	Moderately Adequate	Very Adequate



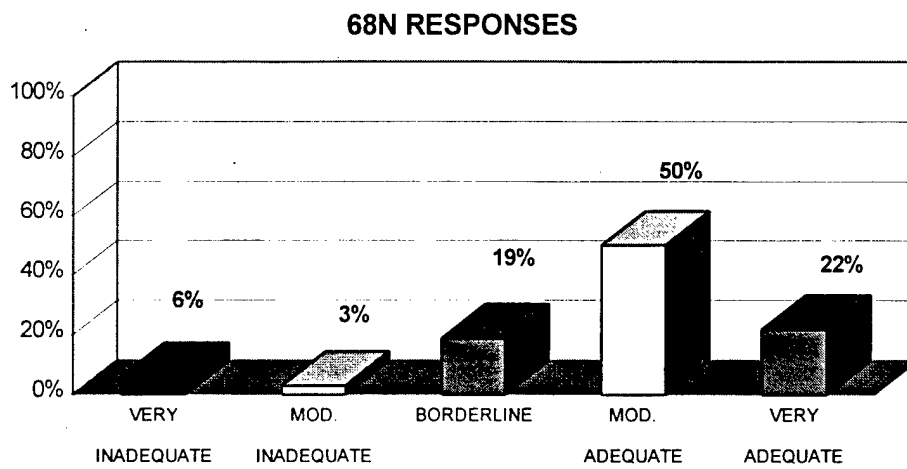
### 67R Comments

No significant comments.



**68X Comments**

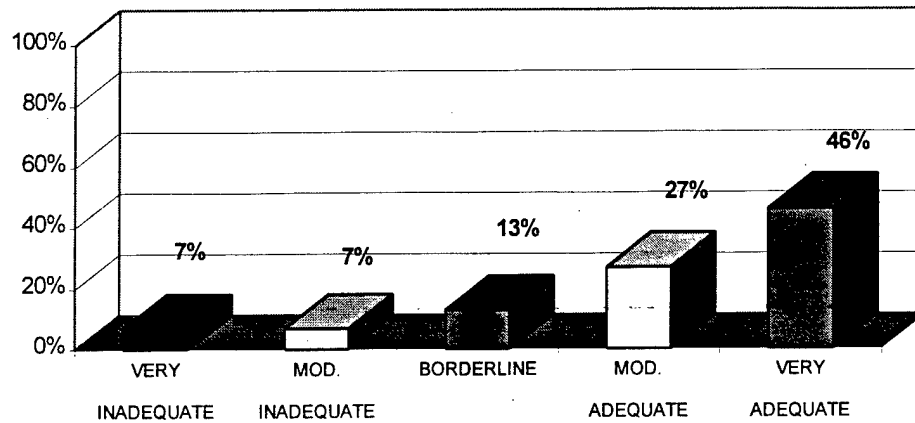
No significant comments



**68N Comments**

No significant comments.

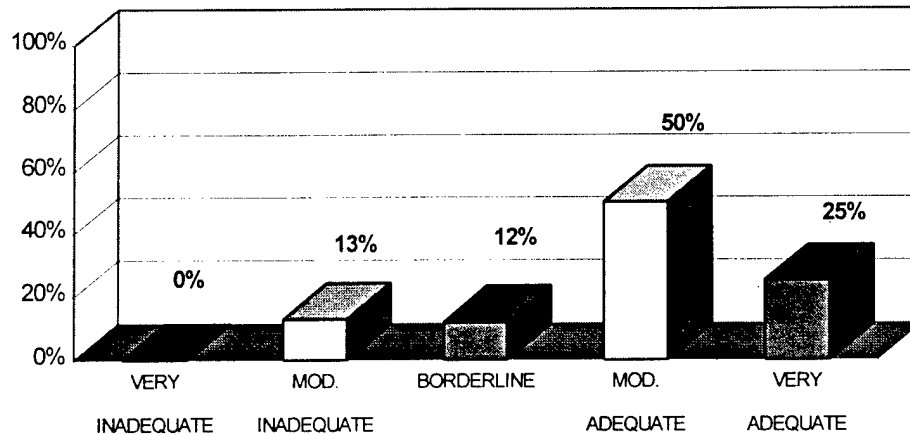
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**AC15. List any gauges or indicators that are difficult to read due to location or size of the gauge or indicator?**

**List gauges or indicators and problems:**

**67R Comments**

**Hydraulic gauges: (11 Comments)**

Primary hydraulic manifold fluid indicator. (4)  
Nickel gauge at utility manifold-nitrogen charge-hyd pressure 0 - 5000. (2)  
Nickel gauge on hyd service panel. (2)  
Accumulator gauge accuracy. (1)  
Nickel gauges, small but close accuracy. (1)  
Pressure on nitrogen accumulator of emergency hydraulic system. (1)

**68X Comments**

**Hour meter gauges: (4 Comments)**

All hour meters on any component. (2)  
TADS and PNVS hour meters are backwards. Should be the same as actual mounting of TADS and PNVS. (1)  
TADS-PNVS hour meters should be moved to a better viewing angle. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**AC16. What are the most significant improvements that could be made to the AH-64 to reduce the time needed to access components?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

Improve accessibility to components: (17 Comments)

Make transducers and switches more accessible. (2)  
Larger APU access. (1)  
Make fuel cell panels larger and easier to remove like rigging. (1)  
Extend access area behind main transmission under engine areas - time savings will depend on component being replaced. (1)  
Make a small tool to access panels. (1)  
Access panel behind pilot's seat to get to servos. (1)  
Panel on belly behind gun turret to get to BUCS pins. (1)  
More hand room for some of the components. (1)  
Don't crowd components together (easier to access and maintain ). (1)  
More access panels. (1)  
More room to work. (1)  
Make the access panels on the stabilator bigger. (1)  
Need new special tools and tool kits for accessing components. (1)  
Make the seats easier to take out and put in(1)  
Holes in the engine exhaust require engine removal to repair. Need access to remove exhaust easily without turbine removal. (1)  
Make the tail rotor gearbox cover into 2 parts like the intermediate gearbox might help. (1)

Need more camlock and dzus fasteners: (7 Comments)

Need more camlocks. (2)  
Make all panels camlock accessible. (1)  
Since the AH-64 is a low speed, high drag aircraft, certain fasteners should be replaced with dzus fasteners and bolts instead of screws. (1)  
Need more dzus fasteners. (1)  
Camlocks on APU cover. (1)  
Dzus fasteners on R and L 545 - would save 20 minutes each time we access the tailboom. (1)

Use fewer or different fasteners: (5 Comments)

There are too many dzus fasteners on the 90 degree gearbox cover. (1)  
Put fasteners on L-160 panel instead of screws. (1)  
L-540 panel needs hasps or clasps instead of turnlocks - would save 2 minutes. (1)



Less screws in trailing edges. (1)

Change 90 degree gearbox dzus fasteners to butterfly fasteners. (1)

### **68X Comments**

#### **Improve Accessibility. (11 Comments).**

Move MRTU type 1's to another place with a quick release door instead of behind L&R 90 panel. Would save 30 minutes to an hour each. (2)

Modularize electrical distribution center. (1)

Make forward flex chute more accessible without dropping the turret - this would save at least 2 hours. (1)

Provide more room in the Aircraft Interface Assembly (AIA). (1)

Components that fail a lot need to be in easier to access positions. (1)

More workspace everywhere on the aircraft would save a lot of time. (1)

Access door to get into MRTU type I. (1)

More hinged panels. (1)

ORT column (hex bolts are in an awkward place). (1)

The ORT and all components. (1)

#### **Use common fasteners. (5 Comments)**

Commonality among fasteners. (3)

Dzus fasteners on all panels. Safe 1 hour. (2)

### **68N Comments**

#### **APR-39. (8 Comments).**

Having the APR-39 receiver in an easily accessible location would reduce replacement time from 8 man-hours to less than one hour. (4)

Better access to APR-39. (2)

Relocate the APR-39 forward receiver. It would save 2 to 3 hours if 68X's did not have to take the Aircraft Interface Assembly (AIA) off. (1)

Put APR-39 forward receiver in a more accessible place. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**AC17. If you have any other problems or comments relating to accessing of AH-64 components, please describe them here:**

**67R Comments**

Accessibility Problems: (5 Comments)

Wing trailing edges are hard to access and time-consuming. (1)  
Bottom panels with screws are hard to access and time-consuming. (1)  
Not enough room overall. (1)  
Getting access to the emergency hydraulic accumulator to perform hydraulic system bleed is impossible with standard tools. (1)  
Long whip antenna gets in the way of working on the tail light. (1)

Component damage: (4 Comments)

Left and right 200 panel - scrapes up EMI tape. (2)  
Main rotor pitch - shims keep debonding and we then have to remove blade and lead lag link. (1)  
L325 has stress cracks from being flung open. (1)

**68X Comments**

Problems with L and R 90 panels. (4 Comments).

R90 has too many screws. (1)  
L90 has too many screws. (1)  
R90 should have a better way of being air and water-tight other than Pro-Seal. (1)  
L90 should have a better way of being air and water-tight other than Pro-Seal. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## FASTENERS

**FA1. Which fasteners (e.g., latches, bolts, screws) are difficult to fasten and unfasten during servicing and removing-replacing of components?**

**List fastener types and components and explain why they are difficult:**

### 67R Comments

#### Tail rotor gearbox panel fasteners: (34 Comments).

Tail rotor gearbox L540 cover. (8)

Tail rotor gear box cover around the swashplate. (6)

Camlocks on L540 around the tailrotor mast head have no room. Three of the camlocks are taped and sort of spring-loaded and hard to install with only one hand and a tail rotor in the way. (3)

Tail rotor gearbox cover has too many camlocks and they are too small in the slot area. (3)

On the Tail rotor gearbox, many times the screws get stuck or fall apart making it important. (2)

Fasteners on #1 side of L540 panel. (2)

Dzus fasteners are inadequate on 90 degree and 42 degree gearbox fairings. (2)

Camlocks on left side of 90 degree gearbox. (1)

Camlocks on 90 degree gearbox cover wear out too fast. (1)

There are too many camlocks on the 90 degree gearbox cover. (1)

Tail rotor gearbox cover - if you split the cover into 2 pieces, it would be easier to unfasten fasteners. (1)

Dzus fasteners in the tail rotor area. (1)

L540 hard to access tail rotor gearbox, a lot of panel damage. (1)

R540 - have to lean over or step on stabilator. (1)

The gearbox shroud between the vertical stabilator and gearbox brace due to poor accessibility. (1)

#### Right and Left 200 panels: (6 Comments)

On R & L 200 panel - install stand-off. (3)

Transmission panels. (2)

L200 is difficult due to steps forward of it. (1)

#### Type of fastener that is a problem: (5 Comments)

Nose gearbox cover- Allen head fasteners were difficult. (2)

Vibrations wears out the camlock retainers faster than the fasteners. (1)

Screws on panels strip out too easily. (1)

Hex screws for nose gearbox covers. (1)

Engine Compartment: (5 Comments)

The upper and lower ones that LN6 and RN6 connect. (2)

Engine nacelle locks always stuck. (2)

Engine shroud fasteners. (1)

Auxiliary Power Unit (APU): (5 Comments)

APU mount bolts. (3)

Double threaded screws on APU shroud. (1)

APU PTO Clutch mount nuts. (1)

Left and Right 545 Panel: (4 Comments)

90 gearbox panel 545 needs dzus fasteners. (2)

Tail boom L & R 545 access cover. (2)

**68X Comments**

Problems with screws. (43 Comments)

Anything with a screw (time consuming). (4)

Screws - because there's a lot of helicopter vibration that causes the screws to tighten. (3)

Screw heads on the PNVS gimbal round out often. (3)

EL resolver cover mounting screws are too soft. (3)

Soft brass head screws get stripped. (2)

Flat tips. With all the types that are available today, the flat tips as on B190 should be eliminated. (2)

L90 panel has too many screws. (2)

R90 panel has too many screws. (2)

Many panel screws get stuck. (2)

The heads round out on many panel screws. (2)

Always replacing dzus fasteners. (2)

Screws on the tensioner access panels. (2)

Flat tips often strip out due to use. (1)

Make bolts and screws captive to avoid FOD. (1)

Connector screws are too fragile. (1)

Azimuth resolver screws strip out. (1)

Right 194 panel has 3 screws right under wing that requires special tools. (1)

Left 194 panel has 3 screws right under wing that requires special tools. (1)

Screws on the turret access panels. (1)

Front FAB panels should have dzus fasteners instead of cross- tip screws. (1)

Belly panel fasteners are always getting bent. (1)  
Screws on the pylon P3 panel don't catch and are difficult to line up. (1)  
Dzus fastener on the turret cover. (1)  
Difficult to align dzus fasteners (difficult to latch). (1)  
Set screw for resolver on the turret. (1)  
The screw under the wing closest to the airframe. (1)

#### Problems with bolts. (13 Comments).

LTU bolts need to be stronger. (3)  
PNVS bolts strip out easily. (2)  
Pylon bolts strip out of the sockets. (2)  
Elevation resolver bolts need to be strong. (1)  
Make bolts and screws captive to avoid FOD. (1)  
LTU aluminum heads round too easily. (1)  
LTU bolts trip too easily. (1)  
PNVS bolts are too soft. (1)  
Bolts on magazine always strip. (1)

#### Problems with plugs. (5 Comments).

P3 rubber seal at top. (2)  
P1 on pylons rarely line up causing them to break. (1)  
P3 on pylons rarely line up causing them to break. (1)  
P3 on the turret cover. (1)

### **68N Comments**

#### Problems with screws. (4 Comments).

Screws need to be replaced often. (1)  
Most all screws on the aircraft. (1)  
Rusted screws. (1)  
Stripped screws. (1)

#### APR-39. (4 Comments)

Screws on the APR-39 receivers. (3)  
APR-39 system fasteners. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**FA2. Which components need captive fasteners (e.g., dzus fasteners, nutplates) the most to make removal and replacement easier?**

**List components:**

### **67R Comments**

Left 545 and Right 545 Access Panels: (6 Comments).

L545 and R545. (6)

Auxiliary Power Unit (APU): (5 Comments).

APU cover panel. (4)

APU cover. (1)

Wing Trailing Edges: (4 Comments).

The wing trailing edges. (2)

Trailing edge dzus fasteners. (2)

### **68X Comments**

Left and Right 90 panels. (25 Comments).

L90 panel. (9)

R90 panel. (9)

R90 has way too many screws. (4)

L90 has way too many screws. (3)

Wing panels and plugs. (6 Comments).

MRTU type II. (2)

Wing cannon plugs to fuselage. (2)

The wing panels. (1)

Wing disconnect panels. (1)

Forward avionics bay panels. (4 Comments).

Forward avionics bay where MRTU's and FAB fans are located. (2)

Forward FAB panels. (2)

**68N Comments**

No significant comments.

**68B Comments**

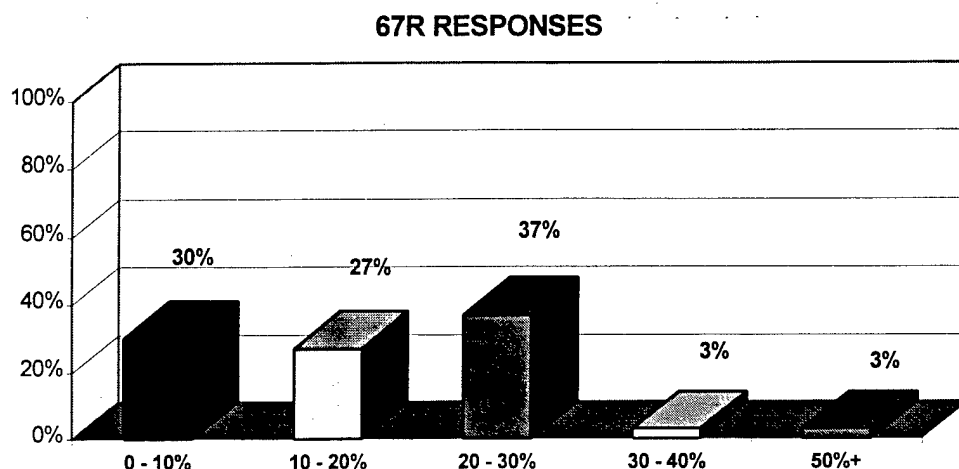
No significant comments.

**68D Comments**

No significant comments.

**FA3. What percentage of time do you accidentally lose non-captive fasteners (e.g., bolts, washers) when servicing or removing-replacing components? (Check one)**

0-10% \_\_\_\_ 10-20% \_\_\_\_ 20-30% \_\_\_\_ 30-40% \_\_\_\_ 50%+ \_\_\_\_



### **67R Comments**

#### **Washers: (5 Comments).**

Fastener washers always break which causes the fastener to fall out when unfastened. (1)

Falls into crack at flight line - wind blows washers. (1)

Bundle connectors shoot washers off when nut is removed. (1)

Washers. (1)

During phase maintenance, we remove so many screws, washers, and bolts that we lose some. (1)

#### **Gearbox Cover Panels: (4 Comments)**

Captive fasteners on gearbox covers deteriorate and fall off. (1)

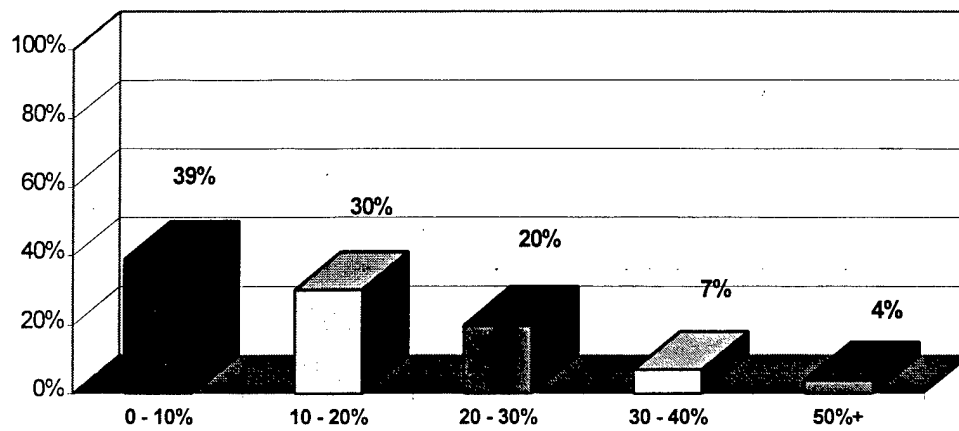
90 degree gearbox cover loses at least one every time. (1)

Tail rotor gearbox fairing. (1)

90 degree gearbox cover. (1)



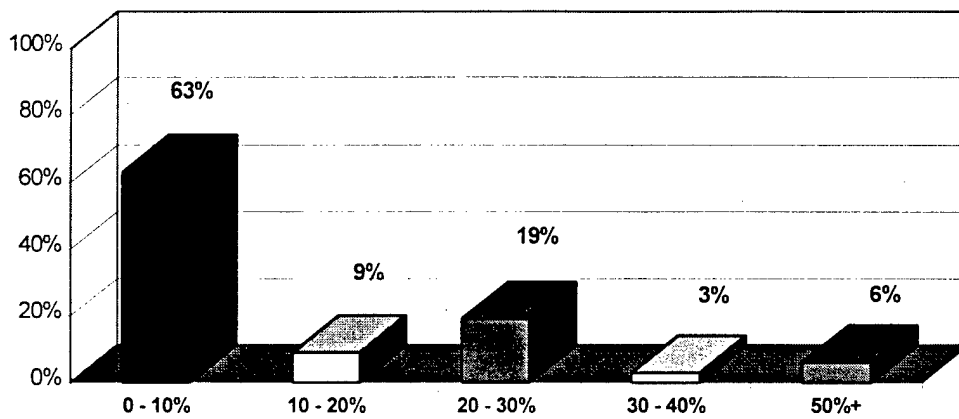
### 68X RESPONSES



### 68X Comments

No significant comments.

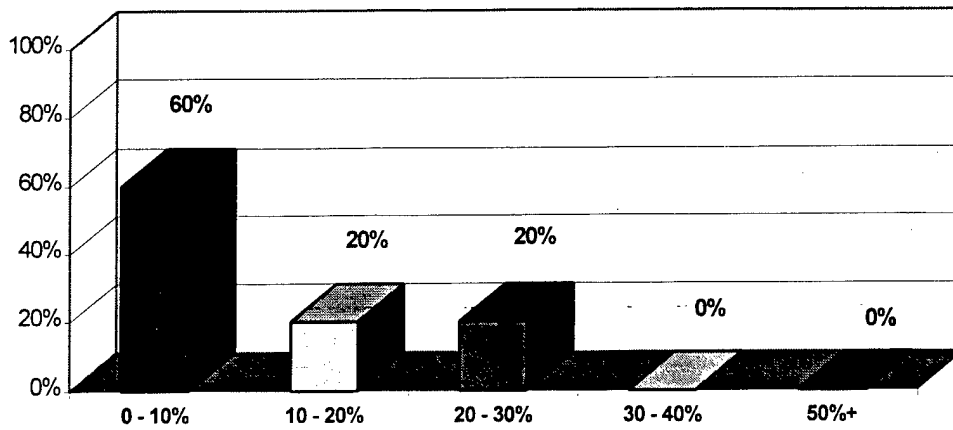
### 68N RESPONSES



### 68N Comments

No significant comments.

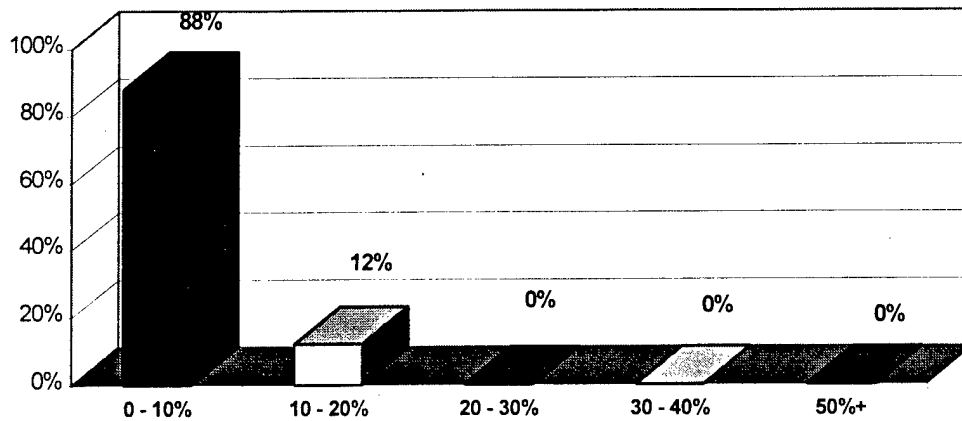
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**FA4. Which components need quick-disconnect fasteners (e.g., 1/4 turn screws) the most to make removal and replacement easier?**

**List components:**

**67R Comments**

Forward Avionics Bay (FAB) Panels: (9 Comments).

FAB fairings (3)

R60. (3)

L60. (3)

Auxiliary Power Unit (APU): (6 Comments)

APU cover panel. (6)

Tailboom Panels: (8 Comments).

Left and Right 545 panels. (3)

Tail rotor driveshaft #6 panel. (2)

Tailboom access panel under stabilator. (1)

Tailboom cover. (1)

Intermediate gearbox access cover. (1)

**68X Comments**

Left and Right 90 panels. (9 Comments).

L90 panel. (4)

R90 panel. (4)

Front panels with MRTU type 1 - too many screws. (1)

Left and Right 60 panels. (4 Comments).

L60. (2)

R60. (2)

**68N Comments**

All components. (5 Comments)

All components. (5)

APR-39 receivers. (5)

APR-39 receivers. (5)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

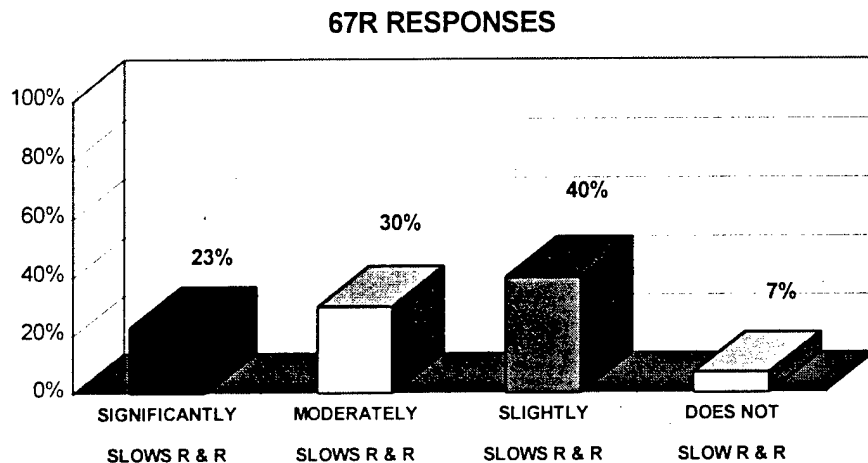
**FA5. To what degree does having to fasten-unfasten different types of fasteners slow removing-replacing of components? (Check one)**

**Significantly slows removing-replacing** \_\_\_\_\_

**Moderately slows removing-replacing** \_\_\_\_\_

**Slightly slows removing-replacing** \_\_\_\_\_

**Does not slow removing-replacing** \_\_\_\_\_



## 67R Comments

### Problems with using different types of fasteners: (10 Comments).

Significantly slows - should use one type of fastener. (2)

Use uniform fasteners. (2)

Significantly slows removing-replacing of 520 panel during phase. (1)

Significantly slows removing-replacing 545 panel (VHF-UHF no.1 antenna). (1)

Moderately slows - certain panels on hard mount areas are slow to remove but required as a structural panel. (1)

Moderately slows - components under the catwalk. (1)

You don't know what (tools) you'll need to remove component-panel until you get there. (1)

It slows the process because you have to keep climbing down off the aircraft to get a different tool. (1)

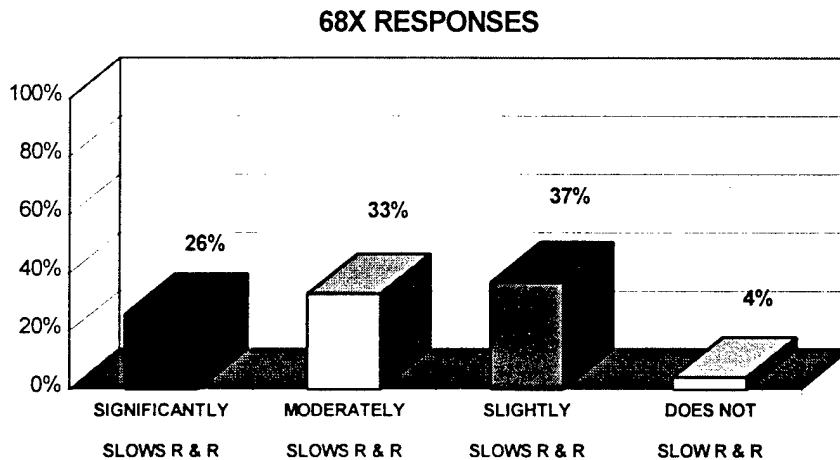
### Problems with screws: (4 Comments).

Screws are time-consuming and the heads strip easily. (1)

Stripped head screws. (1)

Replace screws with bolts. (1)

Go to all thread screws. (1)



## **68X Comments**

### **Need to reduce the number of different types of fasteners. (8 Comments).**

The aircraft needs to stick to one type of fastener to help time management and to reduce the number of tools and help FOD control. (2)

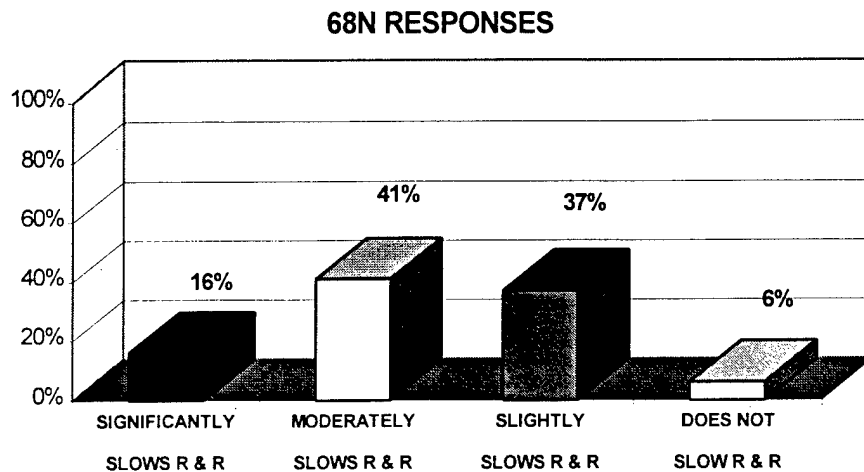
Time spent searching for tools could be used for maintenance. (2)

Significantly slows R&R. For example, the boresight module's mounting hardware is 2 different size Allen head screws within 1 foot of each other. (1)

Need to make them all the same. (1)

Must keep in mind the number and type of tools needed for each. (1)

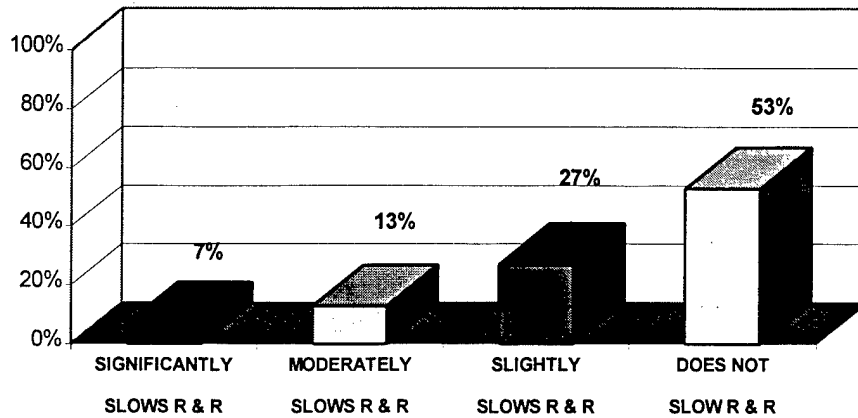
Need to standardize the sizes and types of screws used. (1)



## **68N Comments**

No significant comments.

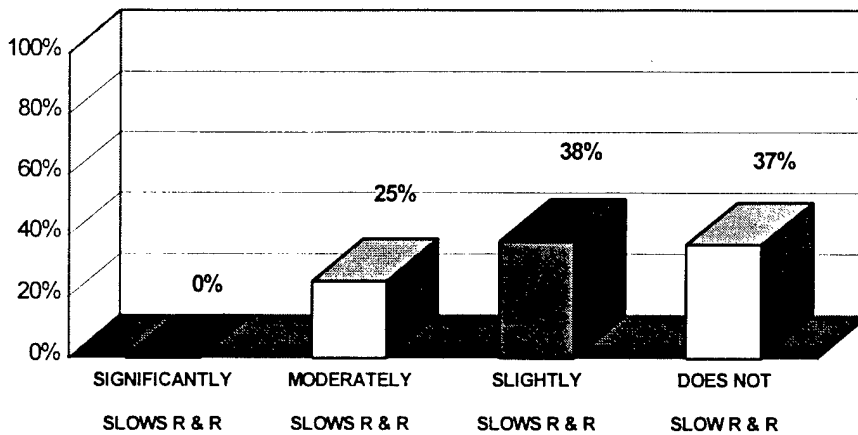
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**FA6. What are the most significant improvements that could be made to reduce the time needed to fasten-unfasten component fasteners on the AH-64?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

Use one type of fastener. (8 Comments).

Keep fasteners uniform.(7)  
Make them all the same. (1)

Use more captive fasteners: (7 Comments).

Make all dzus fasteners slotted for flat tip screwdriver. (1)  
Wing dzus fasteners for front tie-downs - 2 min. (1)  
Install thumb turn dzus fasteners on the Tail rotor gearbox cover. (1)  
Put dzus fasteners in high inspection areas - would save 50% of time. (1)  
Enlarge the size of camlocks. (1)  
Turnlocks. (1)  
Nut plates. (1)

**68X Comments**

Need commonality among fasteners. (9 Comments).

Commonality among fasteners - would save lots of time. (9)

Need captive fasteners. (5 Comments).

Use captive fasteners instead of screws on all panels. (3)  
Panels that we use frequently should have captive screws. (1)  
MRTU type II panel needs captive fasteners. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.



**FA7. If you have any other problems or comments relating to component fasteners for the AH-64, please describe them here:**

**67R Comments**

**Problems with Fasteners: (11 Comments)**

Door latches and striker plates wear out too quickly. (2)

Corrosion on fasteners needs to be solved by making fasteners of non-corrosive material. (1)

The fasteners for L200 and R200 need to have standoffs because they scrape the EMI tape and paint and the bulkhead. LH shroud costs \$9000.00 and the RH shroud costs \$7000.00. (1)

Dzus fasteners seem to pop off too easily. (1)

Engine nacelle locks. (1)

Tail rotor fasteners hard to set. (1)

Quick disconnect fasteners come out too easily. (1)

Backing plates come off (lose fasteners) frequently (1)

Fasteners on pylons break too easily. (1)

Screws get stripped quickly from being taken out and replaced often. (1)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## CONNECTORS

**CN1. List any connectors (e.g., plugs, hoses, cables) that are difficult to connect and disconnect during servicing and removing-replacing of components?**

**List connector types and components**

### 67R Comments

#### Fuel System Component Connectors: (10 Comments)

#2 Engine fuel supply hose quick disconnect is difficult to get too, (6)  
Fuel quantity signal conditioners. (1)  
Engine fuel hose from firewall. (1)  
Aft fuel boost pump. (1)  
Quick disconnect on #1 engine fuel line. (1)

#### Hydraulic System Components Connectors: (9 Comments)

Hyd return pressure hose. (3)  
APU starter hydraulic lines. (2)  
Hyd lines on hyd manifolds (utility and primary) are too close together. (2)  
Tail rotor hydraulic lines are hard and braided. (1)  
Hyd line connectors on GSE panel are hard to remove. (1)

#### Transducers: (5 Comments).

Nose gearbox press transducer. (1)  
Transmission pressure transducer. (1)  
Nose gearbox temperature transducer. (1)  
Transmission temperature transducer. (1)  
Nose gearbox pressure transducer, transmission pressure transducer, nose gearbox temperature transducer, transmission temperature transducer and environmental splice should be twist to unlock and pull to remove. They are in the system - I have the NSN. (1)

### 68X Comments

#### PNVs plugs. (13 Comments).

PNVs cannon plug. (5)  
PNVS plug. (5)

The PNVS connector needs to be a regular cannon plug. (2)  
Grounding stud for PNVS. (1)

HELLFIRE Connectors: (8 Comments)

P511 on HELLFIRE launcher. (3)  
HELLFIRE launcher connector. (2)  
HELLFIRE cannon plug needs to be thinner or the pylon rack needs to be modified.  
It is very difficult to put the cannon plug on once the rack has been installed. (2)  
HELLFIRE rack plug. (1)

Connectors in the wings. (8 Comments).

Wing disconnects. (4)  
MRTU type II screws break easily. (1)  
MRTU type II connector. (1)  
Cannon plugs in wings connecting to the aircraft. (1)  
Hydraulic hoses in the wings connecting to aircraft. (1)

Raychem connectors. (7 Comments)

Raychem connectors. (7)

TADS Connectors. (6 Comments).

TADS ECS motor. (2)  
PIJ3 on ECS. (2)  
Cannon plug on TADS. (1)  
TADS Electronic Control Amplifier (TECA). (1)

30mm turret component connectors. (4 Comments)

Turret control box connectors (3)  
Turret resolver cannon plugs. (1)

**68N Comments**

APR-39 Connectors. (11 Comments).

Forward APR-39 receiver. (5)  
Aft APR-39 receiver. (3)  
J1 and J2 on APR-39 receivers. (1)  
APR-39 system. (1)  
APR-39 BNC connectors. (1)

ADF. (4 Comments).

ADF loop-sense cannon plug. (2)

ADF antenna. (1)

ADF receiver. (1)

#### **68B Comments**

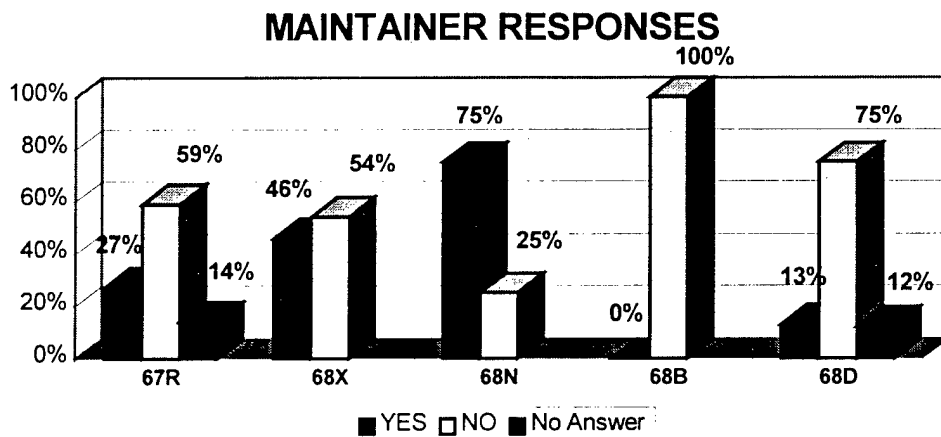
No significant comments.

#### **68D Comments**

No significant comments.

**CN2. Are there any connectors that can be accidentally inserted into a wrong connector (not Murphy-Proofed)?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list connector types and components:**

#### **67R Comments**

BUCS servo connectors - Cannon plugs: (3 Comments).

BUCS servo connectors-cannon plugs. (3)

Environmental Connectors: (3 Comments).

The environmental splice. (2)

Single electrical environmental connectors. (1)

Spindle Connectors: (2 Comments).

Engine spindles. (1)

Power load demand spindles. (1)

Rocket Pod Connectors: (2 Comments).

Rocket pod connectors. (2)

ADS mast power cables: (2 Comments)

ADS mast power cables to deice - colors fade. The two power wires are white and the same size. 50-50 chance of reversal. (2)

Temperature Alarm Connectors: (2 Comments).

Temp alarm connectors. (2)

Connectors - General: (6 Comments)

Stabilator actuator. (1)

Raychem's. (1)

Certain hydraulic lines. (1)

Electric leads on generators can be installed backwards. (1)

Launcher electronics. (1)

Nose gearbox cannon plugs from the NGB fairings. (1)

**68X Comments**

Rocket pod connectors. (7 Comments).

Rocket pod connectors P512 and P513. (4)

Rocket pod connectors. (3)

Rocket launcher fire and fuse connectors. (3)

Rockets. (1)

TADS-PNVS Component Connectors. (4 Comments).

On the TEU, J6 can connect to J7. (2)  
Dayside connectors. (2)

#### **68N Comments**

APR-39 connectors. (12 Comments).

APR-39. (5)  
APR-39 receivers. (5)  
Can switch J1 and J2 or J3 and J5 on APR-39 receiver. (1)  
BNC on APR-39. (1)  
J3, J4, J5 on APR-39 receivers. (1)

Transponder antenna #1 and #2. (4 Comments).

Transponder antenna #1 and #2. (4)

#### **68B Comments**

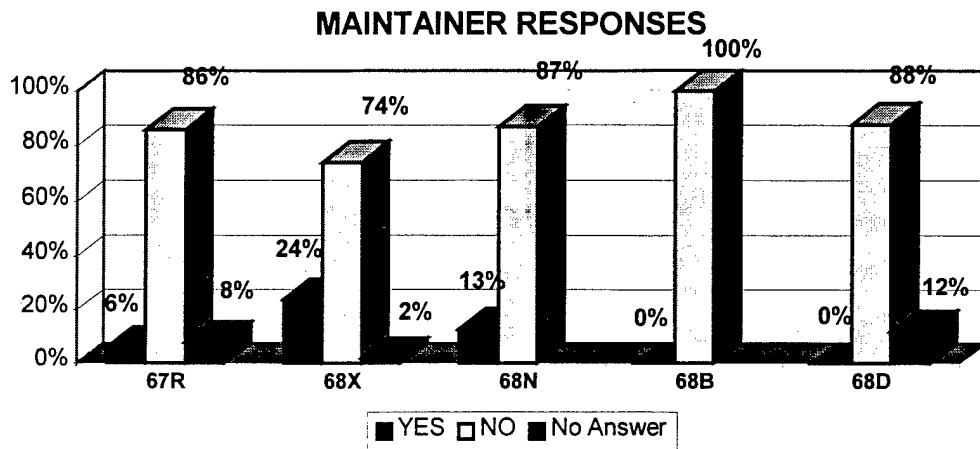
No significant comments.

#### **68D Comments**

No significant comments.

**CN3. Have you ever experienced a safety problem or damage to equipment when a connector was accidentally inserted into a wrong connector?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list connector types, components, and problems:**

**67R Comments**

No significant comments.

**68X Comments**

Rocket pod connectors. (6 Comments)

Rocket pods. (3)

Rocket pod connector was reversed. (2)

Had to replace pylon wiring harness and rocket pod. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

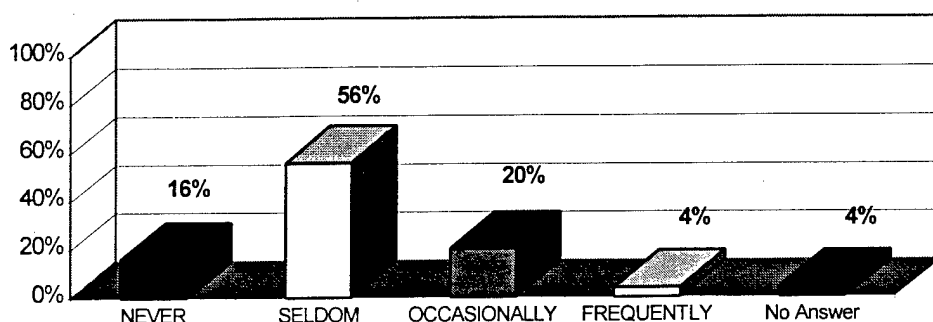
### 68D Comments

No significant comments.

**CN4. When making a blind-mate connection, how often do the connector pins get bent or broken? (Check one)**

Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_

**67R RESPONSES**



**List connectors and components:**

### 67R Comments

Connector pins that get bent or broken: (11 Comments).

DASE computer - occasionally. (2)

RADS power supply - seldom. (1)

Instrument panels - occasionally. (1)

The ones going to the rocket pods and launchers from the pylon - occasionally. (1)

Dirty filters indicators must be inserted perfectly or pins break - seldom. (1)

Hellfire missiles - all the time they get bent and damaged - frequently. (1)

Aircraft Interface Assembly (AIA) connectors - occasionally. (1)

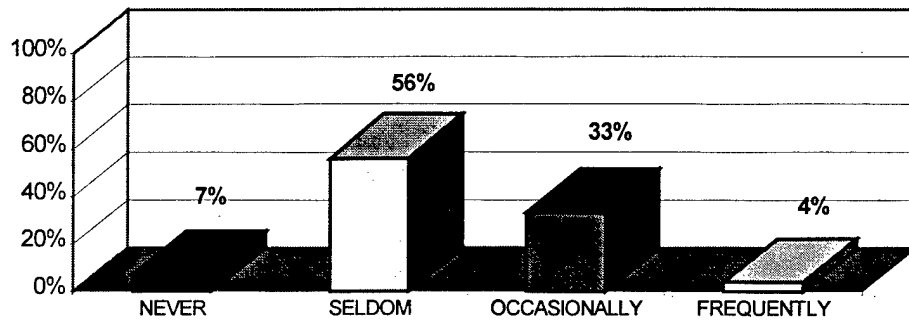
Radios and instruments on consoles - occasionally. (1)

Raychem's - occasionally. (1)

APU - seldom. (1)



### 68X RESPONSES



### 68X Comments

#### PNVS Connectors. (16 Comments)

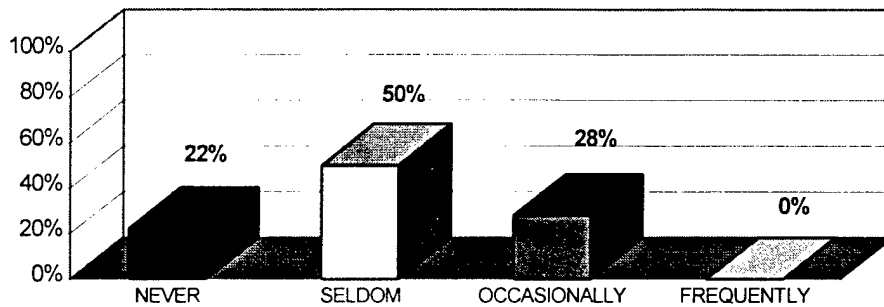
PNVS connectors. (10)

PNVS cannon plug. (4)

PNVS Electronic Control Amplifier (PECA. (1)

PNVS ground strap. (1)

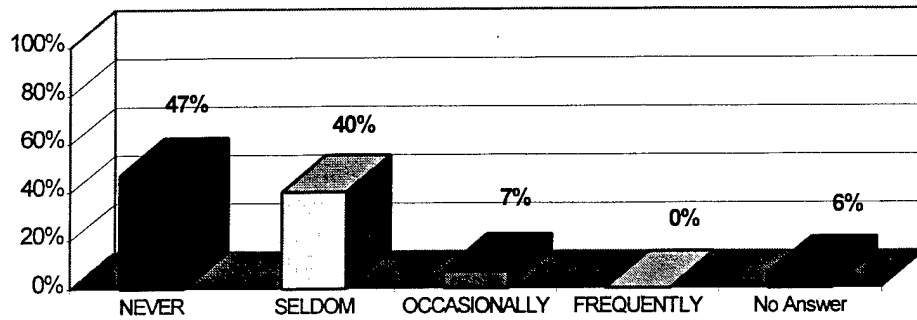
### 68N RESPONSES



### 68N Comments

No significant comments.

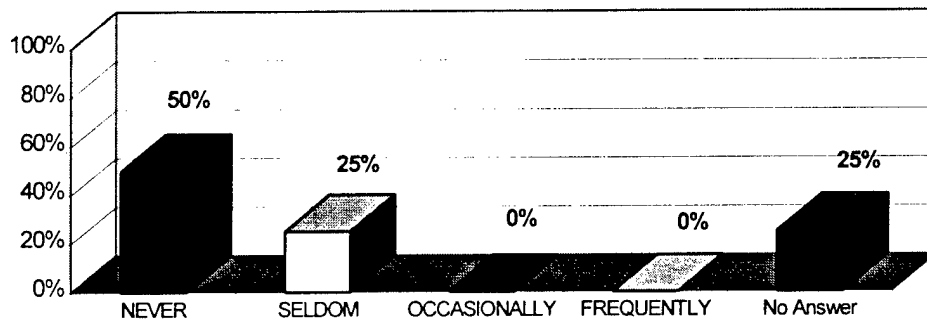
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**CN5. List any connectors that often accidentally get broken?**

**List connectors and components:**

**67R Comments**

Antenna Connectors: (6 Comments)

APR-39 antenna cable connectors.(4)

Antenna on Fabs. (1)

ADF sense antenna. (1)

Transducers: (6 Comments)

Temperature transducer. (3)

Press transducer. (2)

Oil temperature transducer electrical connectors. (1)

T-355 connector: (5 Comments)

Formation light panel 355. (2)

T355 spline gets broken often. (1)

P-355 has a light on top of the panel and those wires get pulled out. (1)

T355 panel. (1)

IHADSS - ICS Connector: (5 Comments)

ICS cord connector pinned to the pilots seat gets yanked out of the block when seat is tilted forward if someone forgets to unpin it from the seat. (3)

IHADSS connector. (2)

Rocket Pod and Missile Launcher Connectors: (3 Comments)

The ones going to the rocket pods and launchers.(2)

The connectors on the Hellfire missiles get bent and damaged all the time. (1)

Nose gearbox connectors: (2 Comments)

Nose gearbox wire strap-on connectors. (1)

Nose gearbox fairing connectors to the de-ice plug get pulled out when fairings are removed.(1)

Auxiliary Power Unit (APU) Connectors: (2 Comments)

APU hour meter wires. (2)

Other Connectors: (6 Comments)

Engine to fire wall connector. (1)

Environmental splice for pressure switch. (1)

A connector on the APR-39 would prevent pulling out the pins on the slime light.  
(1)

Wire on right side of catwalk - have to work around it when doing assy lube oil  
service. (1)

Altimeter wire. (1)

Magnetic pickup wires. (1)

**68X Comments**

IHADSS - ICS connectors. (12 Comments).

IHADSS connectors-cannon plug. (9)

CPG and pilot female receptacle for integrated helmet unit due mostly to pilots  
failing to disconnect prior to egress. (2)

ICS connectors when pilots forget to unplug them prior to egress. (1)

PNVS connectors. (7 Comments).

PNVS cannon plug. (4)

PNVS grounding stud. (1)

PNVS cannon plug usually gets pins bent or won't screw in. (1)

PNVS connector. (1)

Remote HELLFIRE Electronics (RHE) component connectors. (5 Comments)

RHE connector. (4)

RHE with all coaxial cable.(1)

Raychem connectors. (4 Comments).

Raychem connectors. (3)

Raychem connectors behind the CPG seat. People use it as a step when replacing  
the blast shield. (1)

### **68N Comments**

#### **Antenna connectors. (10 Comments)**

All radio antenna connectors. (4)  
ADF antenna connectors. (4)  
The majority of all antenna connectors. (1)  
ARC-201 antenna connectors. (1)

#### **APR-39 connectors. (7 Comments).**

APR-39 connector.(6)  
J-3, J-4, J-5 connectors on APR-39 receivers. (1)

#### **ALQ-136 connectors. (6 Comments).**

Metallic connectors on ALQ-136 receiver-transmitter. (3)  
ALQ-136 antenna cables. (2)  
ALQ-136 cables. (1)

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**CN6. List any connectors that often come loose on their own?**

**List connectors and components:**

### **67R Comments**

#### **APR-39 Connectors (5 Comments).**

APR-39 connectors. (4)  
APR-39 antenna. (1)

Tailrotor Gearbox Panel Connectors: (2 Comments)

Connectors on 90 degree gearbox cover. (1)  
L540 connectors. (1)

Other Connectors: ( 7 Comments)

Electrical environmental connectors - if not properly locked - which may be difficult.  
(1)  
Tail wheel lock connectors. (1)  
ENCU surge valve. (1)  
Antennas. (1)  
Raychem connectors (ALQ-144-ALQ-136).(1)  
Plug on main rotor magnetic pickup. (1)  
Depending on the aircraft, all connectors get loose, usually due to not properly  
being replaced after an inspection. (1)

**68X Comments**

No significant comments.

**68N Comments**

Radar Altimeter. (7 Comments)

Radar altimeter antenna connectors. (5)  
APN-209 antenna's (but not if they're safety-wired).(1)  
APN-209 antenna's.(1)

APR-39. (6 Comments)

APR-39 receiver connectors. (3)  
Rear APR-39 antenna.(2)  
J-3, J-4, J-5 connectors on APR-39 receivers. (1)

Radios antennas. (5 Comments)

CPG's VHF radio antenna connector vibrates loose. (5)

**68B Comments**

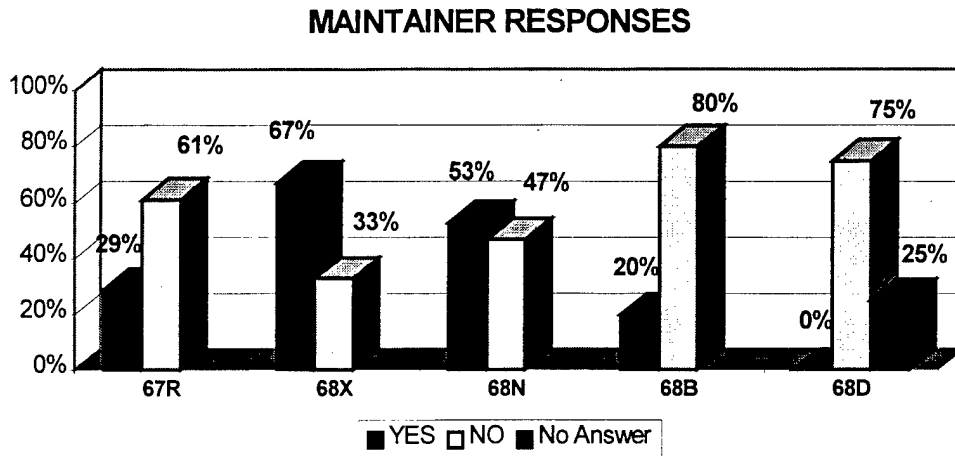
No significant comments.

### 68D Comments

No significant comments.

**CN7. Do you have to bend or sharply twist cables or hoses when making a connection due to location or position of a component?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list type of hoses or cables and components:**

### 67R Comments

No significant comments.

### 68X Comments

TADS-PNVS compartment cables and hoses. (23 Comments)

PNVS cables. (7)  
Boresight module. (5)  
TADS Electronic Control Amplifier (TECA). (3)  
ECS. (2)  
Aircraft Interface Assembly (AIA). (2)  
PNVS Electronic Control Amplifier (PECA). (2)  
TADS connectors (Dayside). (1)  
PNVS grounding strap. (1)

HELLFIRE launcher cables. (8 Comments).

From wing stores pylon to HELLFIRE missile launcher cable-connection. (3)

P511 on HELLFIRE launcher. (3)

HELLFIRE. (1)

Rocket pod-missile rack. (1)

**68N Comments**

ALQ-136 cables. (9 Comments)

ALQ-136 RT antenna connection. (3)

ALQ-136 cables constantly break. (3)

ALQ-136 antenna. (2)

Semi-rigid cables on ALQ-136. (1)

APR-39 cables. (6 Comments).

APR-39 system connectors. (5)

APR-39 antenna. (1)

Radios cables. (4 Comments).

Radios. (1)

Radio connectors. (1)

ARC-164. (1)

The cables that hook up the radios because the cables are too short. (1)

**68B Comments**

No significant comments.

**68D Comments**

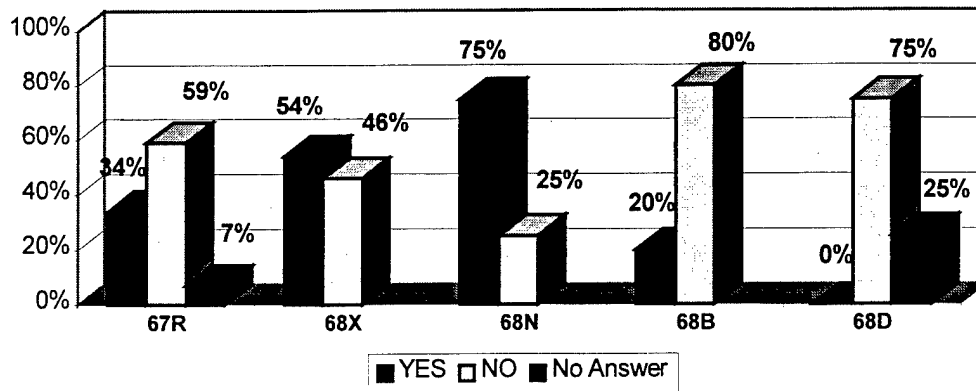
No significant comments.



**CN8. Are there any components where there is not enough service loop in wires and harnesses to easily make a connection?**

Yes \_\_\_\_\_ No \_\_\_\_\_

#### MAINTAINER RESPONSES



**If yes, list wires or harness and components:**

#### 67R Comments

Nose Gearbox Wire Harness: (7 Comments)

De-ice nose gearbox heaters electrical harness.(3)  
 Nose gearbox heater blanket plug wire. (3)  
 Nose gearbox wire harness.(1)

#### 68X Comments

TADS-PNVS Compartment components. (14 Comments).

TADS Electronic Control Amplifier (TECA). (3)  
 Boresight module. (3)  
 PNVS. (3)  
 PNVS Electronic Control Amplifier (PECA. (2)  
 PNVS cable. (1)  
 PNVS grounding strap. (1)  
 ECS.(1)

Crewstation compartment components. (8 Comments).

Instrument panels in both cockpits.(2)  
All pilot console components.(2)  
All CPG console components. (2)  
Avionics panel in pilots compartment. (1)  
VDU never has enough slack for its connection. (1)

**68N Comments**

Radios. (13 Comments).

Most all radios.(4)  
Pilot station radios. (2)  
All radios. (2)  
VHF. (1)  
UHF. (1)  
Radio antenna connection.(1)  
ARN-89 loop ant corr.(1)  
Not enough slack on antenna connectors to radio after you have had to re-do connector. (1)  
CPG station radios. (1)

ASE equipment. (7 Comments).

ALQ-136. (3)  
APR-39 aft ant cables.(1)  
APR-39 forward receiver. (1)  
J1 and J2 on rear APR-39 receiver. Civilians completing MWO's would leave J1 or J2 disconnected because they were not long enough.(1)  
ALQ-144. (1)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**CN9. What are the most significant improvements that could be made to reduce the time needed to connect-disconnect component connectors on the AH-64?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

No significant comments.

**68X Comments**

Need more cannon plugs. (13 Comments).

Use cannon plugs instead of Raychem connectors. (6)

Cannon plugs are easier to service and repair and remove and don't get damaged as easily. (2)

Make PNVS connector round and twist on-off rather than screw in. Would save 30 minutes easy. (2)

Cannon plug for the turtle back slime light would save 1/2 to 1 1/2 hours. (1)

Need a regular cannon plug for the PNVs. (1)

Cannon plug on temp transducers for XMSN. (1)

Use components that have quick-disconnects. (4 Comments).

Make components with quick releases. (3)

Make the boxes quick-disconnect and have the plugs on the back with alignment pins and then 2 screws up front to hold the box in place. (1)

**68N Comments**

Cable and wire length. (8 Comments).

Make the cable long enough to remove item and disconnect. (4)

Allow more service loop in wire harnesses. (1)

Make wire longer-would - save 40% of time. (1)

Make harnesses longer - would save 40% of time. (1)

Need more service loop for antennas in consoles. (1)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**CN10. If you have any other problems or comments relating to component connectors for the AH-64, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

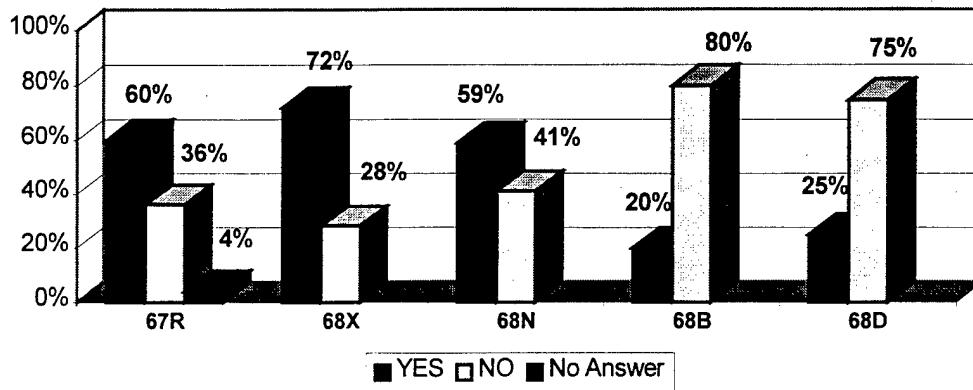
No significant comments.

## LABELS AND MARKINGS

**L-M1. Are there any labels or markings (e.g., cable tags, serial #'s) that are often:**

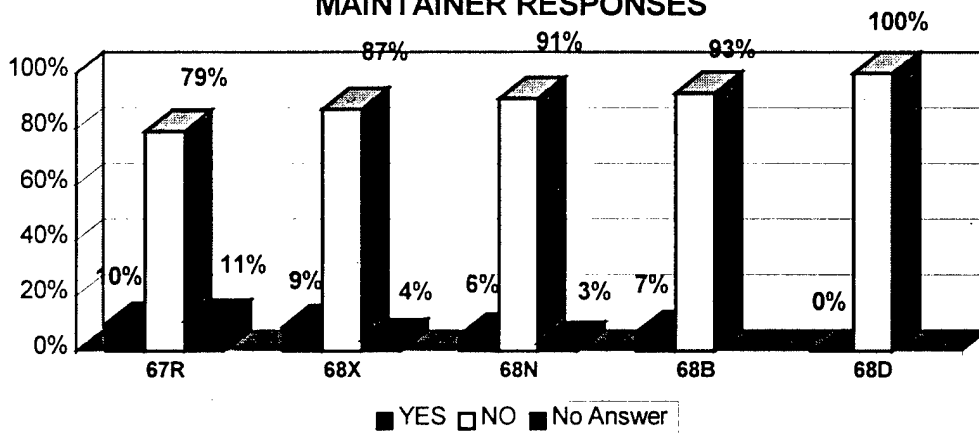
**a. Missing**      Yes \_\_\_\_\_      No \_\_\_\_\_

### MAINTAINER RESPONSES



**b. Incorrect**      Yes \_\_\_\_\_      No \_\_\_\_\_

### MAINTAINER RESPONSES



**If yes, list labels or markings and components:**

**67R Comments**

**Wire or cable tags and labels - General: (18 Comments).**

Missing wire harness tags. (3)  
Majority of them. (3)  
Stamps for serial numbers should be made after painting and should be more definite. (2)  
Hydraulic lines lose their labels. (2)  
Wire markers missing and incorrect. (1)  
Missing most marked cables. (1)  
Serial number tags fall off and get lost or just break apart. (1)  
Markings rub off with time. (1)  
Electrical leads on generators are rarely marked. (1)  
All tags that are adhesive(e.g., antenna's hydraulic lines). (1)  
Missing wire behind transmission. (1)  
ADF antenna. (1)

**Main rotor system labels or markings: (11 Comments).**

Main Rotor data plate fly's off often. (5)  
Main Rotor PC links. (3)  
Main Rotor blade nameplates. (3)

**Data plates - General: (8 Comments).**

Data plates on any component - missing. (3)  
Data for transmission oil coolers - missing. (1)  
Data for transmission supports - missing. (1)  
Tail rotor pc links. (1)  
Intermediate gearbox data plates. (1)  
Main transmission data plate. (1)

**Servo-cylinder labels or markings: (5 Comments).**

Missing - tags on servo's. (3)  
Servo cylinders. (2)

### **68X Comments**

#### **Labels and markings on wires and cables. (13 Comments).**

Wire bundle labels are missing. (3)  
The tags fall off of most cables. (2)  
Wire harness labels missing. (2)  
The markings on wires often get worn off by heat. (1)  
Markings on wires often get worn off by the weather. (1)  
Markings on wires often get worn off by working with them a lot. (1)  
There is no number (PN or NSN) on P6 on the TEU to order the cable. (1)  
Transmission wire markings are faded. (1)  
Cable tags with harness information isn't always present. (1)

#### **TADS Aircraft Interface Assembly (AIA). (4 comments).**

TADS Aircraft Interface Assembly (AIA). (4)

### **68N Comments**

#### **Labels - General: (10 Comments)**

Most all are missing. (4)  
Wire numbers are difficult to read after they get worn. (2)  
Wire harnesses are not marked enough. (1)  
Labels get very faint with time. (1)  
Data plates often fall off. (1)  
After awhile, oil rubs the labels off. (1)

### **68B Comments**

No significant comments.

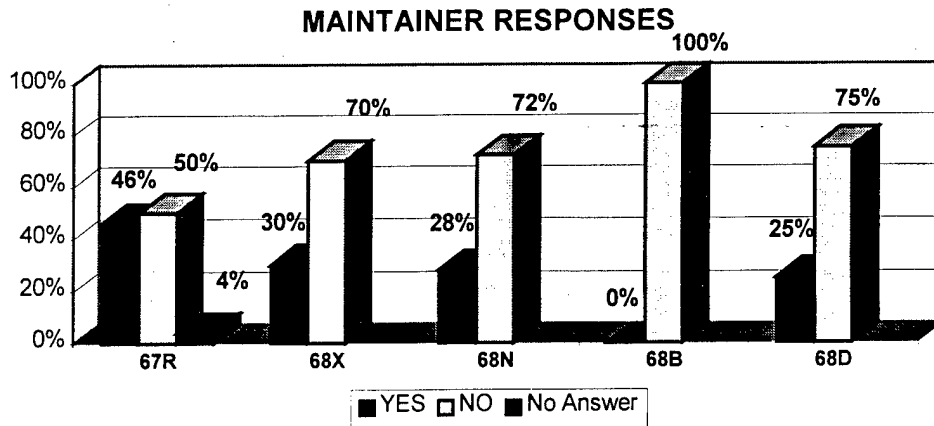
### **68D Comments**

#### **Labels or markings that are missing. (4 Comments).**

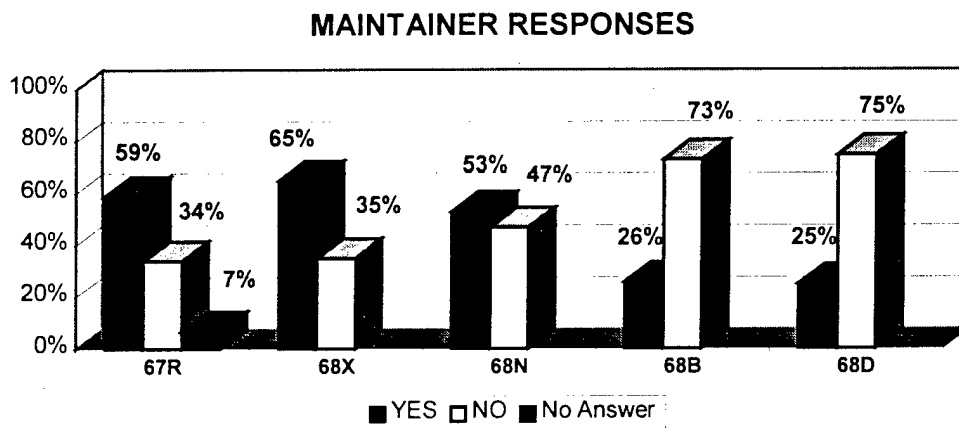
Nose gearbox part #'s. (1)  
G/B serial #'s. (1)  
Transmission #'s. (1)  
Everything is missing. (1)

L-M2. Are there any labels or markings that are difficult to read due to:

a. Size Of Label-Marking      Yes \_\_\_\_\_ No \_\_\_\_\_



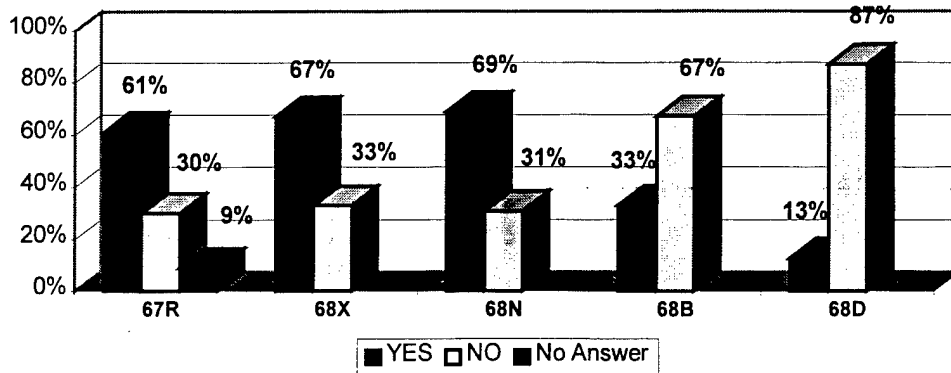
b. Location Of Label-Marking      Yes \_\_\_\_\_ No \_\_\_\_\_





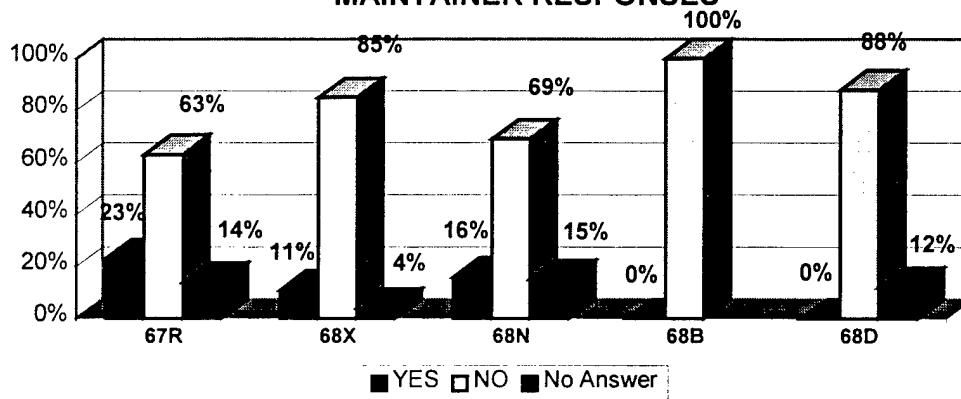
c. Fading of Label-Marking Yes \_\_\_\_\_ No \_\_\_\_\_

#### MAINTAINER RESPONSES



d. Other Problems With Reading Label-Marking (List Below) Yes \_\_\_\_\_ No \_\_\_\_\_

#### MAINTAINER RESPONSES



If yes, list labels or markings and components:

#### 67R Comments

a. Labels and markings that are difficult to read due to location:

Main rotor system: (9 Comments)

The lead lug damper rod ends on the main rotor are difficult to read due to their location. (2)

Most markings on the head and Tail rotor assembly. (2)  
Main Rotor P-C link label. (2)  
Main Rotor head components. (1)  
Tip cap data plate on Main Rotor blade. (1)  
Servo rod ends label. (1)

Location - General: (22 Comments).

Serial number due to location. (4)  
Location on component. (2)  
SDC data plate. (2)  
Part number due to location. (1)  
NSN due to location. (1)  
SN# on trackable items during phase.(1)  
SN# check. (1)  
Location-fading of labels on transmission bay.(1)  
Engine history recorders. (1)  
Generator wires labels too small to see.(1)  
Majority. (1)  
Battery compartment.(1)  
Altimeter serial number. (1)  
M130 dispenser serial number.(1)  
All. (1)  
Wire markings. (1)  
Servo cylinder data plates need to be moved. (1)

b. Labels and markings that are difficult to read due to size:

Main rotor system: (6 Comments).

Most markings on the head and tail rotor assembly.(2)  
Main Rotor P-C link label. (2)  
Main Rotor head components.(1)  
Servo rod ends label. (1)

Size-General: (10 comments).

SDC data plate. (2)  
SN# on trackable items during phase. (1)  
SN# check. (1)  
Majority. (!)  
Battery compartment.(1)  
Altimeters serial number. (1)  
M130 dispenser serial number. (1)  
All. (1)

Wire Markings. (1)

c. Labels and markings that are difficult to read due to fading.

Main rotor system: (5 Comments).

Main Rotor P-C links numbers. (3)

Most markings on the head and Tail rotor assembly. (2)

Fading - General: (16 Comments)

Some fade or fall off of various components. (3)

SDC data plate. (2)

Serial # fading out. (2)

The braces for the transmission. (1)

Aluminum plates rub flat and scrape off. (1)

Serial # on trackable items during phase. (1)

Serial # check. (1)

Aircraft numbers (e.g., 9000 314). (1)

Engine history recorders. (1)

Fuel lines rub against other items and labels fade. (1)

All. (1)

Wire markings. (1)

**68X Comments**

a. Labels and markings that are difficult to read due to location:

TADS-PNVS compartment components. (11 Comments).

Dayside. (2)

Location of serial number on PNVS shroud should be on outside. (2)

Serial numbers are hard to locate without removing the component. (1)

The serial number of the DSA is usually under the TV sensor and should be plain sight. (1)

Nightside. (1)

TV camera. (1)

Indirect View Display (IVD) ID tag. (1)

PNVS Electronic Control Amplifier (PECA). (1)

Boresight module. (1)

Difficult to read due to fading. (4 Comments).

Difficult to read serial numbers because they fade. (2)

Anything exposed to light fades. (1)

Fading of serial number of Ferguson cam requires etching by us each time we get one. (1)

#### **68N Comments**

No significant comments.

#### **68B Comments**

Difficult to read due to fading. (4 Comments).

Data plates on the engine, over time. (1)

Engine serial number is too small. (1)

Labels on fuel lines. (1)

Labels on oil lines. (1)

Difficult to read due to location. (3 Comments).

Data plates on the engine, over time. (1)

Labels on fuel lines. (1)

Labels on oil lines. (1)

#### **68D Comments**

Labels or markings that are difficult to read due to location. (3 Comments)

G/B part #'s. (1)

G/B serial #'s. (1)

Transmission #'s. (1)

Labels or markings that are difficult to read due to size. (3 Comments).

G/B part #'s. (1)

G/B serial #'s. (1)

Transmission #'s. (1)

**L-M3. List any test points on the components that are not adequately labeled?**

**List components and test points :**

#### **67R Comments**

No significant comments.

#### **68X Comments**

No significant comments.

### 68N Comments

No significant comments.

### 68B Comments

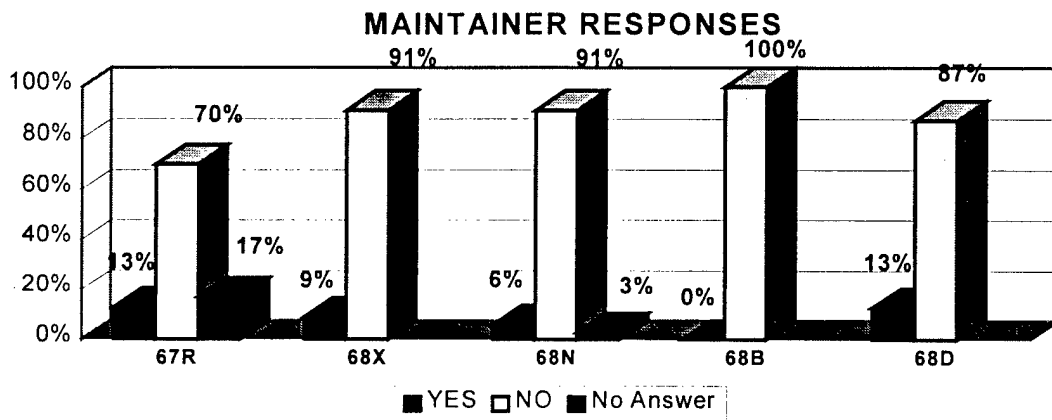
No significant comments.

### 68D Comments

No significant

**L-M4. Are there any safety hazards on the components or aircraft that are not labeled?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, describe safety hazards:**

### 67R Comments

#### Safety Hazards: (7 Comments)

Tail rotor blades. (1)

Keeping GSE access panel open with APU running. (1)

Generator labels. (1)

Warning LASER. (1)

Fuel cell overflow -vent not labeled. (1)

Label fire bottles (because of explosive cartridges). (1)

Mark the catwalk to stay clear of APU as mechanics sometimes have to be in the catwalk while the APU is running.(1)

#### **68X Comments**

No significant comments.

#### **68N Comments**

No significant comments.

#### **68B Comments**

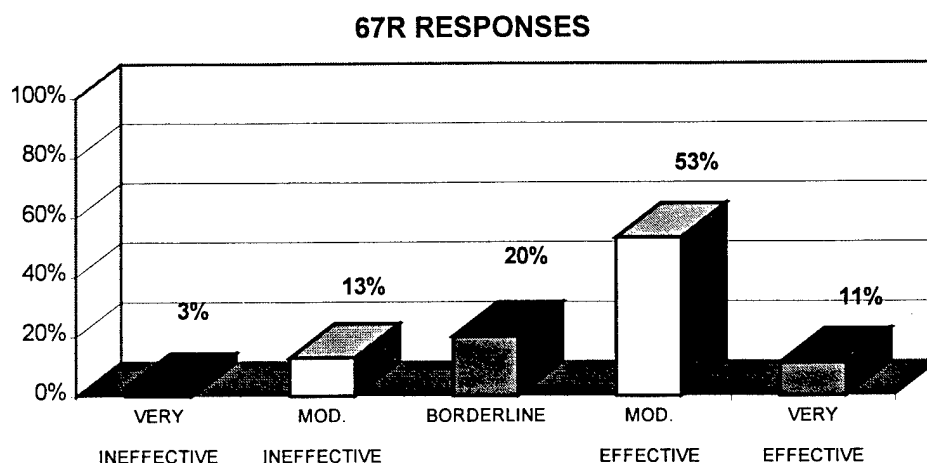
No significant comments.

#### **68D Comments**

No significant comments.

**L-M5. How effective are the labels on the aircraft (e.g., "no step") for preventing damage to personnel and equipment? (Circle one)**

5	4	3	2	1
Very Ineffective	Moderately Ineffective	Borderline	Moderately Effective	Very Effective



### **67R Comments**

#### **Fading of Labels: (6 Comments).**

"No steps" usually fade out. (3)

The CARC and black paint fade together and disappear. (1)

They need to have something where heat or sun doesn't fade them away. (1)

Hard to read after exposure to sunlight. (1)

#### **"No step" areas are often stepped on: (4 Comments)**

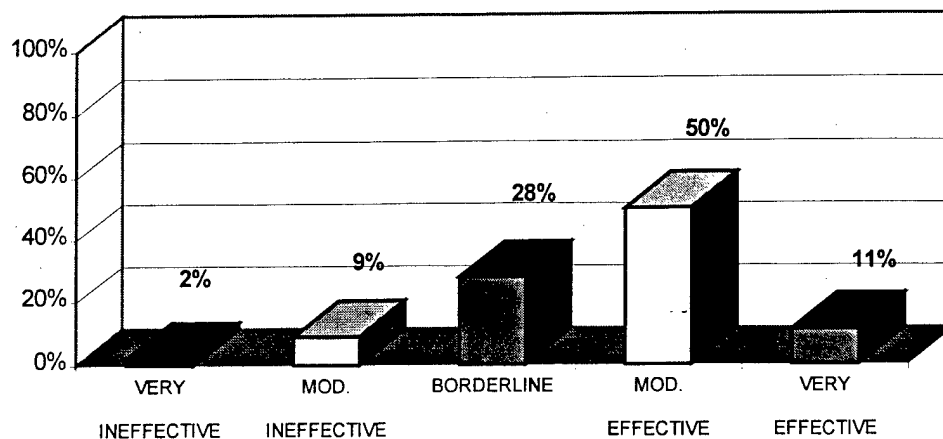
Nose gearbox is often stepped on by every LAR. (1)

Engine nacelle's are often stepped on even by LAR. (1)

People step on them to get easier access to components. (1)

The "no step" labels are sometimes hard to see because of all the footprints. (1)

### 68X RESPONSES



### 68X Comments

Components still get stepped on. (5 Comments)

They still get stepped on. (5)

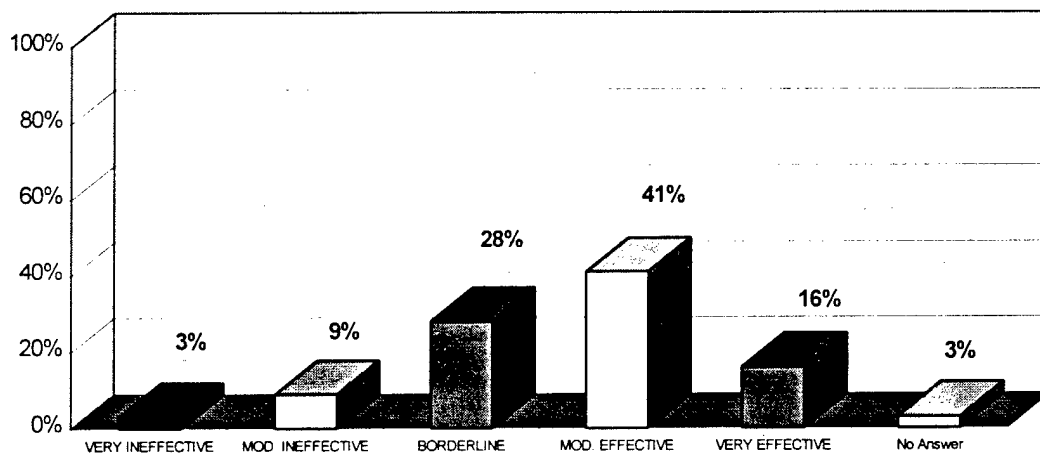
Rocket Pod "No Step" label. (4 Comments)

Rocket pod "no step" often has foot print of Peter pilot. (2)

Need something better for rocket pods. (1)

Rocket pod labels are borderline. (1)

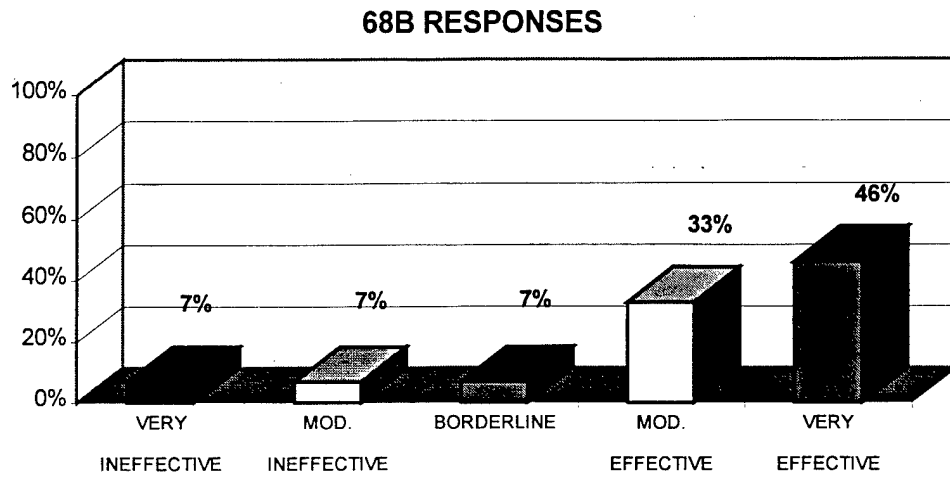
### 68N RESPONSES





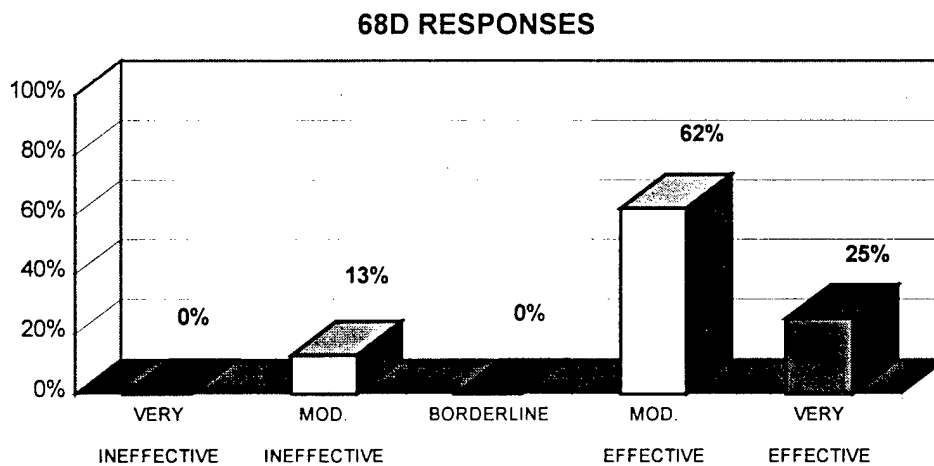
### 68N Comments

No significant comments.



### 68B Comments

No significant comments.



### 68D Comments

No significant comments.

**L-M6. List any problems you have had identifying and reading labels or markings while wearing MOPP IV gear?**

**List labels and-or markings:**

**67R Comments**

Cannot read labels effectively: 17 Comments)

Can't see labels or markings easily. (4)

The labels are written too small to read with MOPP gear. (4)

All of them. (3)

Almost impossible. (2)

All labels. Unit hasn't issued connection lenses for protective mask. (1)

Hard to get your head into tight places with mask on. (1)

Most of them. (1)

Cannot read flow (direction) markings. (1)

Haven't tried reading labels with MOPP IV gear: (7 Comments)

Haven't done it. (4)

Not tried. (2)

Never tried except to replace parts on Longbow project at McDonnell Douglas. (1)

**68X Comments**

Problems identifying or reading labels. (8 Comments).

It's just hard to read through the mask. (3)

All view is restricted when wearing a MOPP IV mask. (2)

Small labels and markings. (1)

Most electrical components. (1)

Put on a mask and squeeze your head into any access panel or into the Aircraft Interface Assembly (AIA) or ORC. (1)

**68N Comments**

MOPP IV Mask (6 Comments).

Can't see labels with MOPP IV mask. (5)

Cannot see hardly anything in MOPP IV. (1)

### 68B Comments

No significant comments.

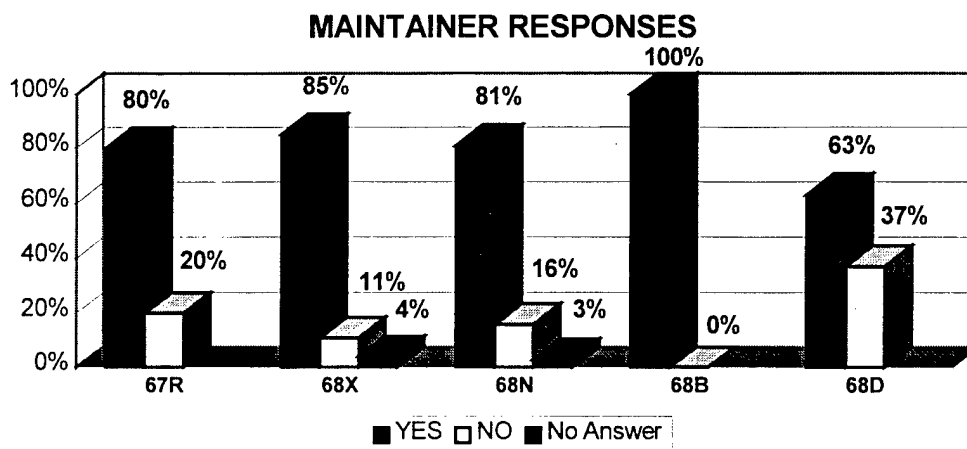
### 68D Comments

No significant comments.

**L-M7. Are weight limits stenciled on the integral work platforms (e.g., engine cowlings) on the aircraft?**

Yes \_\_\_\_\_ No \_\_\_\_\_

If no, list integral work platforms:



### 67R Comments

Engine door platform not labeled: (6 Comments)

Engine door platform. (3)

Engine nacelle. (3)

### 68X Comments

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

Maintenance platforms. (3 Comments)

Maintenance platforms. (3)

**L-M8. If you have any other problems or comments relating to labeling or marking of aircraft components, please describe them here:**

**67R Comments**

Problems seeing labels: (4 Comments).

The labels are too small. (1)

Labels are too small on the main rotor.(1)

Labels are too small on the drive shaft cover. (1)

When approaching aircraft from the front, you need the ID readily visible.

Sometimes you search the whole flightline for an aircraft because of glare and faded paint. (1)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## LIFTING AND CARRYING

**L-C1. List any components which need handles to make them easier to remove and replace?**

**List components:**

### 67R Comments

#### Auxiliary Power Unit (APU): (9 Comments)

APU. (8)

APU hoist loop is too small. (1)

#### Aircraft Seats: (6 Comments)

Aircraft seats. (6)

#### Ammo box: (5 Comments)

Ammo box. (2)

Ammo drum. (2)

Ammo pack. (1)

#### Gearboxes: (4 Comments)

Nose gearbox. (3)

Gearbox's. (1)

#### Transmission: (4 Comments)

Transmission. (4)

### 68X Comments

#### 30mm gun system components. (27 Comments).

Magazine for 30mm cannon. (12)

Gun turret. (11)

AWS gun. (3)

Ammo. (1)

TADS-PNVS compartment components. (9 Comments)

PNVS. (5)

DSA. (2)

NSA. (2)

**68N Comments**

ALQ-144. (8 Comments).

ALQ-144. (8)

ALQ-136 receiver transmitter. (5 Comments)

ALQ-136 receiver transmitter. (5)

**68B Comments**

No significant comments.

**68D Comments**

Gearboxes. (4 Comments).

90 degree tailrotor gearbox. (1)

Nose gearbox. (1)

Intermediate gearbox. (1)

Gearboxes. (1)

**L-C2. List any components that are too heavy to be lifted by the specified number of personnel?**

**67R Comments**

No significant comments.

**68X Comments**

30mm gun system components. (4 Comments)

Turret. (2)

Gun. (1)

Ammo magazine. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**L-C3. List any components that are too awkward to be easily lifted by the specified number of personnel?**

**67R Comments**

Gearboxes: (11 Comments).

Tail rotor gearbox. (6)

Nose gearbox. (3)

Intermediate gearbox. (1)

Gearboxes. (1)

Pilot and CPG Seats: (8 Comments).

Pilot and CPG seats. (8)

Auxiliary Power Unit (APU): (4 Comments)

APU. (4)

**68X Comments**

30mm gun system components. (14 Comments).

Gun turret. (10)

Gun turret is too awkward for four people once its removed.(2)

Ammo can. (2)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**L-C4. List any components which have handles that are too small to easily grasp and hold?**

**List components and handles:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.



**L-C5. List any components which do not have the proper placement of handles or grasp areas?**

**List components and handles-grasp areas:**

**67R Comments**

No significant comments.

**68X Comments**

30mm gun system components. (7 Comments)

Gun turret. (5)

Ammo magazine. (2)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

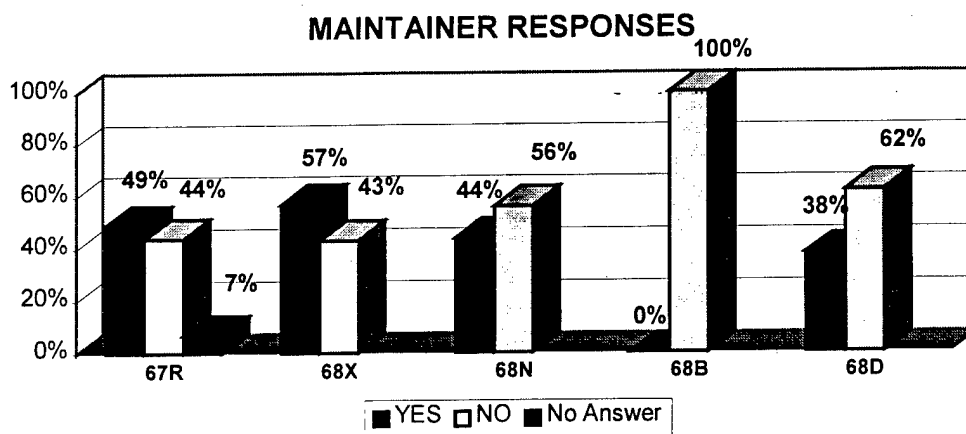
**68D Comments**

No significant comments.

**L-C6. Are there any components that are difficult or awkward to carry to or from the aircraft due to:**

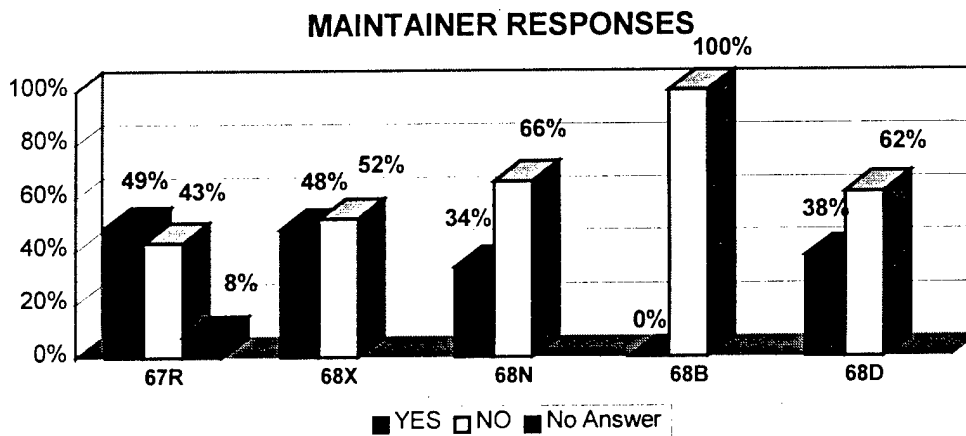
**a. Weight**

Yes \_\_\_\_\_ No \_\_\_\_\_

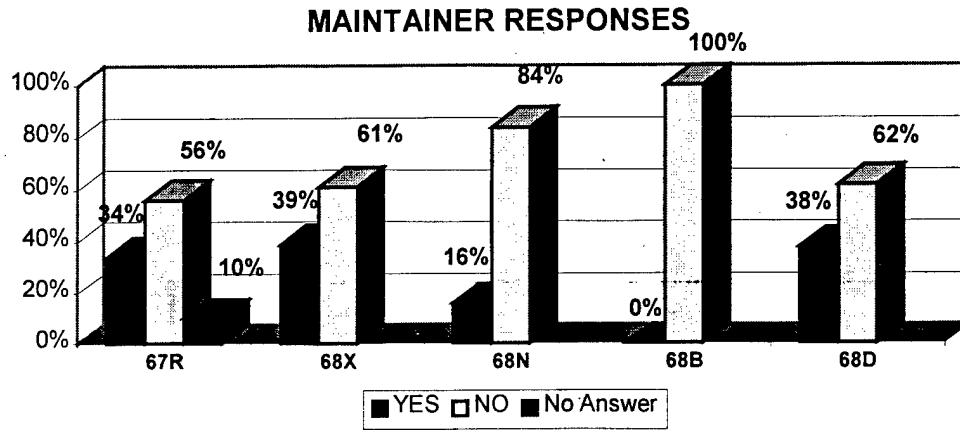


**b. Size**

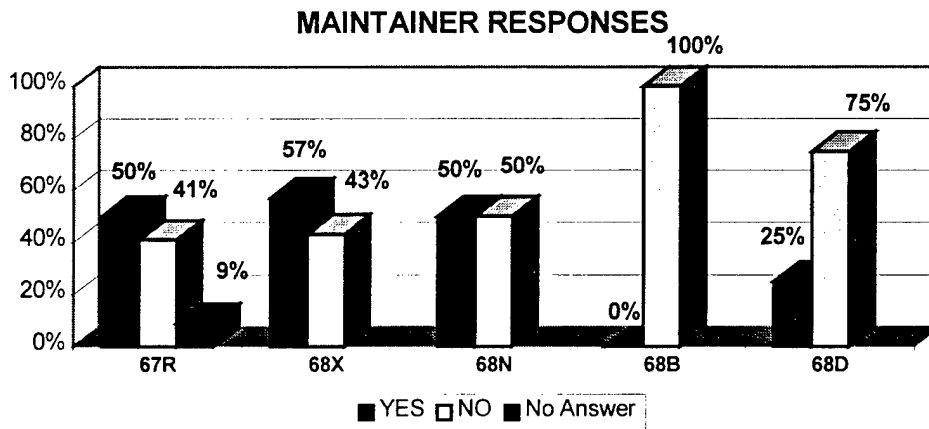
Yes \_\_\_\_\_ No \_\_\_\_\_



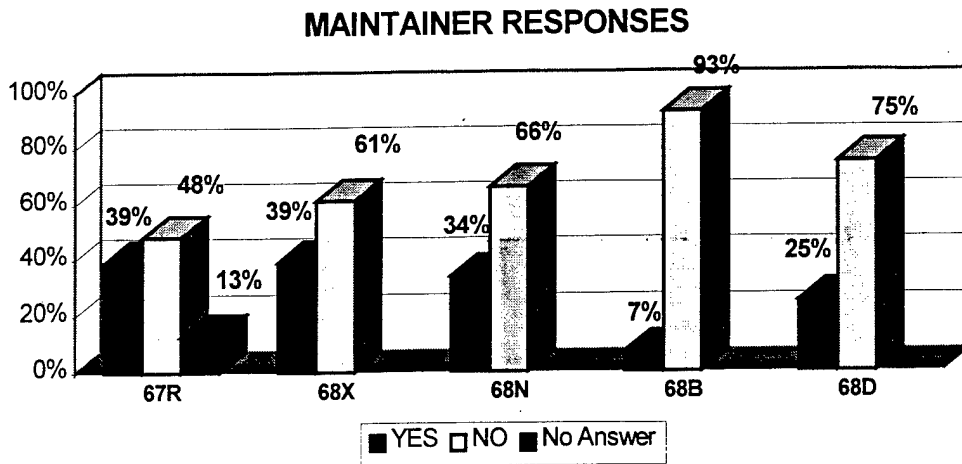
c. Center of Gravity      Yes \_\_\_\_\_ No \_\_\_\_\_



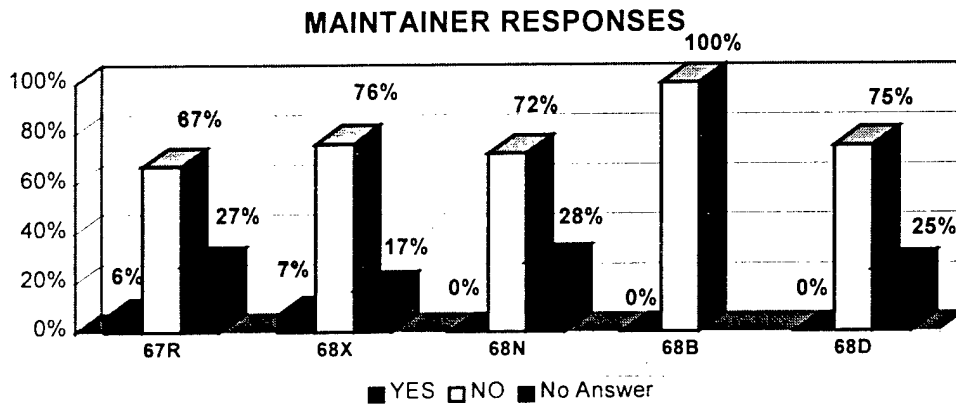
d. Lack of handles      Yes \_\_\_\_\_ No \_\_\_\_\_



e. Lack of grasp areas      Yes \_\_\_\_\_ No \_\_\_\_\_



f. Other Problems (List Below)      Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list components and describe problems:**

**67R Comments**

Pilot and CPG seats due to weight, size, center of gravity and lack of grasp areas:  
(9) Comments.

Seats. (6)

Armor, seats (damage radios) when removing and installing. (2)

Seats are awkward to install, often damage radios and CPG door windshield. (1)

Gearboxes due to weight, size, center of gravity and lack of grasp areas:  
(5 Comments).

Nose gearbox. (3)

Tail rotor gearbox. (2)

**68X Comments**

30mm gun system components. (39 Comments).

Gun turret. (10)

The ammo magazine needs to have handles. (8)

Gun. (6)

Rounds magazine. (4)

The turret is heavy. (3)

The gun is heavy. (2)

The turret is very awkward. (2)

The turret assembly needs a lift to roll under aircraft. (1)

Turret is a pain in the butt to take out and install. (1)

The gun is very awkward. (1)

Hard to find a good place to hold the gun turret due to the cables and hydraulic hoses on it. (1)

TADS-PNVS compartment components. (5 Comments).

Dayside assembly. (2)

Aircraft Interface Assembly (AIA). (1)

Nightside assembly. (1)

PNVS. (1)

### 68N Comments

ASE Equipment. (9 Comments).

ALQ-136. (5)

ALQ-144. (4)

### 68B Comments

No significant comments.

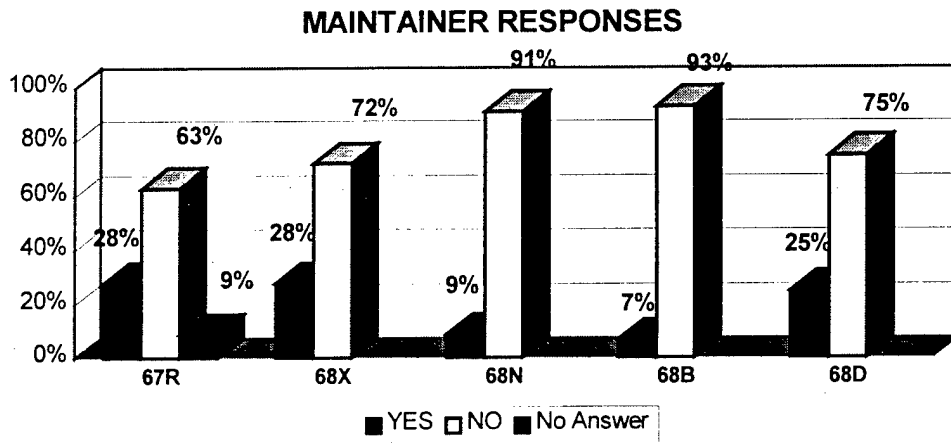
### 68D Comments

No significant comments.

**L-C7. Do you need any equipment (e.g., hoist, crane) not provided to you at AVUM to lift and move components?**

Yes \_\_\_\_\_ No \_\_\_\_\_

**If yes, list equipment:**



### 67R Comments

Tugs: (6 Comments)

Tug. (6)

### **68X Comments**

Need equipment for removal and installation of the Aircraft Interface Assembly (AIA). (4 Comments)

For removal and installation of the Aircraft Interface Assembly (AIA). (3)  
Hoist for the Aircraft Interface Assembly (AIA). (1)

### **68N Comments**

No significant comments.

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

**L-C8. What are the most significant improvements that could be made to reduce the time needed to lift and carry components to and from the AH-64?**

**List improvements and amount of time you think it would reduce:**

### **67R Comments**

Need tugs, carts and stands: (7 Comments)

Need at least 4 to 5 1/4 ton mules on the flight line to service aircraft. (2)  
Better carts (all sizes). (2)  
Need a tug avail at all times (either have to push it or use a HMMV to do the job). (2)  
More stands. (1)

### **68X Comments**

Need more carts. (11 Comments).

Need more carts. (3)  
Carts-jacks for turret and ammo boxes. (2)  
A golf cart and trailer to haul parts and equipment to and from the flightline. (1)  
Gold carts or 4-wheelers to carry parts to flight line. (1)

Every place needs a cart of some sort. (2)  
Tri-cycles should be added to TOE to assist in flight line maintenance. (1)  
Transportation to and from acft (e.g., carts).(1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**L-C9. If you have any other problems or comments relating to the lifting and carrying of components for the AH-64, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.



## **REMOVAL & REPLACEMENT**

**RR1. Which components are the most difficult to remove and replace at AVUM?**

**List components and describe problems:**

### **67R Comments**

#### **Transmission Components: (11 Comments)**

Transmission. (10)

Accessory pump on transmission. (1)

#### **Fuel Cells: (11 Comments).**

Fuel cells - too many small panels and the mounting bolts have pro-seal on them with limited access. (9)

Aft fuel cell. (1)

Fuel cells. (1)

#### **Gearboxes: (11 Comments)**

Tailrotor gearbox in the field (5)

Nose gearboxes. (2)

90 degree gearbox cover. (2)

Accessory gearbox pump. (1)

Accessory gearbox filter due to location. (1)

#### **Auxiliary Power Unit (APU): 10 Comments.**

APU. (7)

APU mounts. (1)

APU boost press switch. (1)

PTO clutch. (1)

#### **Environmental Control Unit (ENCU): (9 Comments.**

ENCU. (5)

ENCU cooling turbine due to location. (3)

ENCU turbine lube lower plug. (1)

Shaft driver compressor (SDC): (8 Comments).

SDC (shaft driver compressor). (8)

Crewstation compartment: (5 Comments)

Det cords. (2)

SPADS. (1)

Door latches-locks. (1)

Transparent blast shield. (1)

Main Rotor System Components: (5 Comments)

Swashplate. (2)

Main rotor strap packs. (2)

Rotor head. (1)

Pilot and CPG seats: (4 Comments).

CPG seat. (2)

Crew seats. (2)

Servo cylinders: (4 Comments)

Servos. (3)

Servo cylinders in the XMSN bay. (1)

**68X Comments**

TADS-PNVS Compartment Components. (19 Comments).

Aircraft Interface Assembly (AIA) - too much time. (6)

Boresight module. (2)

PNVS connector. (2)

Aircraft Interface Assembly (AIA) - because you have to remove so many other components. (2)

PNVS Electronic Control Amplifier (PECA). (2)

TADS turret assembly. (1)

ECS - its hard to remove because of all the components around it. (1)

ECS fan (1)

TADS Electronic Control Amplifier (TECA). (1)

Boresight Module Assembly (BMA). (1)

30mm gun system components. (14 Comments).

Gun turret - getting it out from under the aircraft. (7)  
M230 slide bearings. (2)  
Ammo carriers. (2)  
Gun - need 1/2" or 3/4" more room on wire strike in rear. (1)  
Azimuth gimbal. (1)  
Turret wire harness. (1)

ORT Components. (5 Comments).

ORT column. (3)  
Indirect View Display (IVD) due to no space. (2)

**68N Comments**

APR-39. (19 Comments).

APR-39A forward receiver. (12)  
APR-39A aft receiver. (7)

HARS. (5 Comments).

HARS. (5)

**68B Comments**

Inertial particle separator (IPS). (3 Comments).

5th nut on IPS case half. (2)  
One of the five bolts in the back of the particle separator is hard to get to. (1)

**68D Comments**

Main rotor components. (3 Comments).

Main rotor pitch control rod end bearings. (1)  
Strap pack (bolts, shoes, blades). (1)  
Main rotor hub-it is heavy and difficult to assembly. (1)

Hydraulic pressure swaging. (3 Comments).

Hydraulic press removal (double swaged). (1)  
Hydraulic press swaging. (1)  
Tooling for press swaging. (1)

**RR2. Which component supply parts are not readily available at AVUM?**

**List supply parts not readily available:**

**67R Comments**

Main Rotor System Supply Parts: (12 Comments)

PC link nuts. (7)  
Main rotor strap packs. (3)  
Main rotor. (2)

Common hardware: (11 Comments)

Common hardware. (4)  
Nuts. (2)  
Bolts. (2)  
Packings. (2)  
Gaskets. (1)

Most or all supply parts: (11 Comments).

All of them. (4)  
Just about all of them. There is never any money available for parts. (2)  
70% of them. (2)  
All of them. Get off the pot and make sure parts help us keep the aircraft up. (1)  
Most all. (1)  
Lots. (1)

Transducers: (6 Comments)

Temperature transducers. (3)  
Transducers. (1)  
Pressure transducers. (1)  
Transmission transducers. (1)

Transmission Components: (6 Comments).

Transmission. (3)  
Transmission clutches. (3)

Auxiliary Power Units (APU): (4 Comments)

APU's. (4)

**68X Comments**

**TADS-PNVS Components. (9 Comments).**

LTU (laser transceiver Unit). (2)

Aircraft Interface Assembly (AIA). (2)

TADS parts. (2)

Pins for connectors. (2)

Laser tracker. (1)

**30mm gun system components. (5 Comments).**

M230 slide bearing mount bolts. (1)

Gun equipment. (1)

Loader box parts. (1)

Turret motor. (1)

Ammo feed parts. (1)

**Pylon Racks. (4 Comments).**

Bolts for the pylon racks. (3)

Parts for the pylon racks. (1)

**68N Comments**

**Splices. (4 Comments).**

Splices. (3)

Environmental splices. (1)

**68B Comments**

**Gas Generator (GG) rotor components. (3 Comments).**

GG rotors, #1 carbon seals. (2)

Nuts for the hot end of engine when replacing CG rotors. (1)

**68D Comments**

**Main rotor and tail rotor components. (9 Comments).**

Main rotor pitch control rod end bearings. (3)

PLI washers for main rotor head. (2)

Nuts for damper bolts. (1)

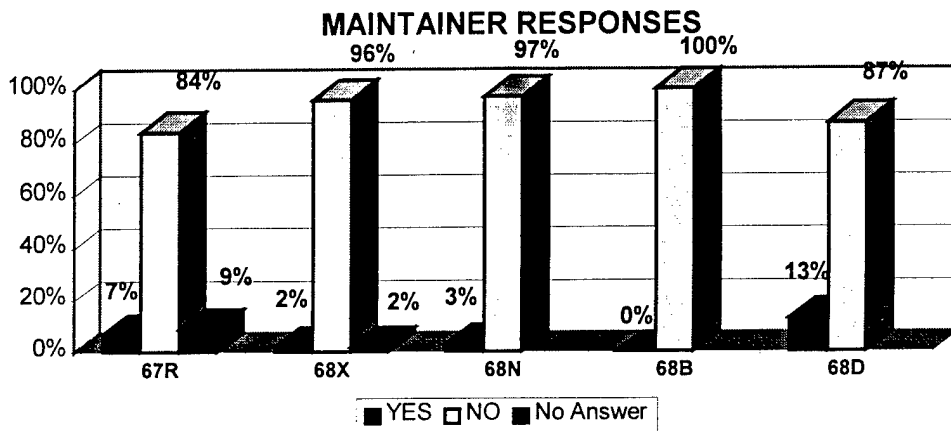
P-C rod bolts. (1)

Main rotor head bolts. (1)

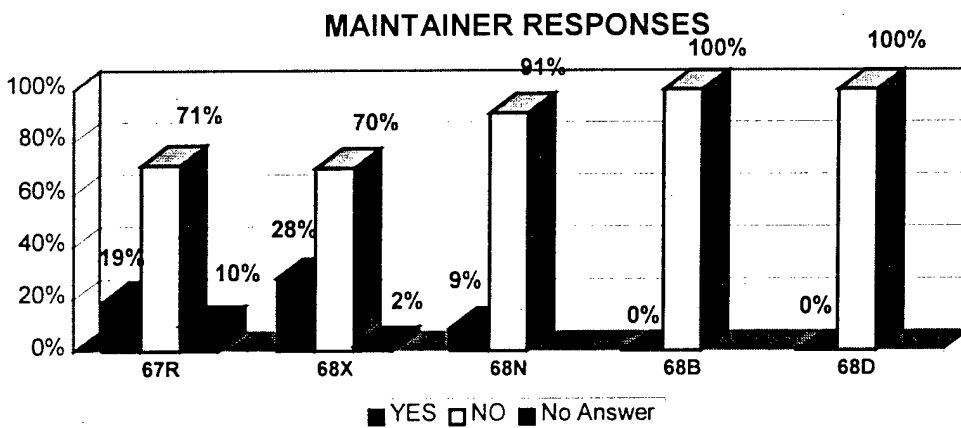
Tail rotor pitch control rod end bearings. (1)

**RR3. When ordering supply parts, are there any forms-records that need to be changed because they:**

**Do not contain all the needed information**      Yes \_\_\_\_\_ No \_\_\_\_\_



**Are difficult and time-consuming to complete** Yes \_\_\_\_\_ No \_\_\_\_\_



**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**RR4. Which supply parts do you often run out of at AVUM?**

**List supply parts:**

**67R Comments**

**Common Hardware: (41 Comments)**

Common hardware. (7)

Screws. (6)

Nuts. (6)

Bolts. (5)

Packings. (5)

Washers. (4)

Dzus fasteners. (2)

Spacers. (2)

Preformed packings. (1)

Self locking nuts. (1)

Cotter pins. (1)

PLI washers for the tail rotor. (1)

Main Rotor System Components: (20 Comments).

PC link nuts. (8)  
Main rotor strap packs. (3)  
Main rotor PC link nuts. (3)  
PC links (main rotor). (3)  
Main rotor hub crush washers. (1)  
Main rotor scissors nuts. (1)  
Main rotor scissors. (1)

Transducers: (14 Comments)

Transducers. (5)  
Temperature transducers. (5)  
Main rotor transducers (temperature and pressure). (2)  
Tail rotor transducers. (2)

Filter Components: (9 Comments)

All filters. (6)  
Pop-up indicators. (2)  
Fuel filters. (1)  
Filter indicators. (1)

Pressure Switches: (4 Comments)

Pressure switches. (4)

**68X Comments**

TADS-PNVS supply parts. (11 Comments).

TADS parts. (6)  
Shrouds. (1)  
PNVS. (1)  
TADS Electronic Control Amplifier (TECA). (1)  
TPS. (1)  
Combiner lens. (1)

Splices. (10 Comments)

Splices. (10)



30mm gun system supply parts. (8 Comments)

Gun parts. (5)  
Flex chutes. (1)  
M230 slide bearing mounting pins. (1)  
Re-coil adapters. (1)

Extractors. (5 Comments).

Extractors. (5)

Packings. (4 Comments)

Packings. (4)

**68N Comments**

Splices. (9 Comments)

Splices. (9)

ADF. (6 Comments)

ARN-149 parts (ADF). 2)  
Sense antenna on ADF. (1)  
ADF receiver. (1)  
ADF amplifiers. (1)  
ADF connectors. (1)

APR-39. (5 Comments)

APR-39 aft receiver brackets. (2)  
APR-39 antennas. (1)  
APR-39 cables. (1)  
APR-39 receivers. (1)

Relays. (4 Comments).

Relays. (4)

### **68B Comments**

#### **Common Hardware. (7 Comments).**

Common hardware (e.g., nuts, bolts, packing). (7)

#### **G-Axis seals. (3 Comments)**

Axis G-seals. (3)

### **68D Comments**

#### **Main rotor and tail rotor supply parts. (11 Comments).**

Main rotor pitch control rod end bearings. (4)

Tail rotor pitch control rod end bearings. (2)

PLI washers. (1)

Main rotor head bolts/nuts. (1)

Damper nuts/bolts. (1)

Retainers on pitch housing. (1)

Self-locking nuts on L/L link. (1)

#### **Gearbox supply parts. (4 Comments).**

Nose gearbox seals. (2)

G/B seals. (1)

Nuts for the retainer on the #2 nose gearbox output seal. (1)

**RR5. Which supply parts take the longest to receive after they have been ordered?**

**List replacement parts and how long you usually have to wait:**

### **67R Comments**

#### **Most or all supply parts: (11 Comments)**

All of them. (7)

Most all of them. (4)

#### **Main Rotor System Parts: (9 Comments).**

PC link nuts. (4)

Strap packs - 4 to 10 months. (1)

Main rotor parts. (1)

PC links. (1)

Main rotor head. (1)

Feather bearings for main rotor head - have to wait one month for new main rotor head. (1)

Transducers: (4 Comments)

Temperature transducers. (3)

Transducers. (1)

**68X Comments**

TADS-PNVS parts. (12 Comments).

TADS parts. (4)

LTU. (2)

PNVS. (2)

TADS Power Supply (TPS). (1)

TADS Electronic Unit (TEU). (1)

Martin Marietta parts. (1)

Have to wait 2 or more months for TADS parts. (1)

30mm gun system parts. (11 Comments).

30mm gun parts. (10)

Have to wait 2 or more months for gun parts. (1)

Common Hardware. (6 Comments).

Bolts. (2)

Washers. (1)

Nuts. (1)

Bench stock. (1)

Screws. (1)

Cannon plug parts. (4 Comments).

Cannon plugs. (1)

Cannon plug parts. (1)

Cannon plug pins. (1)

Cannon plug sockets. (1)

**68N Comments**

Splices. (7 Comments).

Splices. (7)

Video recorder. (5 Comments)

Video recorder. (5)

ADF. (4 Comments)

ADF (ARN-149). (4)

### **68B Comments**

No significant comments.

### **68D Comments**

Main rotor and tail rotor component parts. (6 Comments).

Main rotor pitch control rod end bearings (90 to 120 days). (2)

Tail rotor PC rod end bearings (6950's) - wait months. (2)

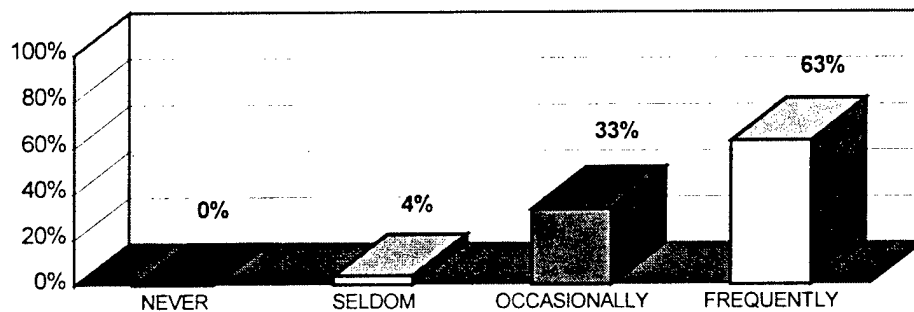
Damper nuts/bolts - can take 2 - 3 weeks. (1)

Strap pack. (1)

**RR6. How often does lack of getting supply parts in a timely manner keep aircraft from being mission ready? (Check one)**

**Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_**

**67R RESPONSES**



## **67R Comments**

### **Problems with the supply system: (16 Comments)**

Don't have the particular parts on hand, so the acft stays down until we receive the parts. (4)

Supply system too slow. (3)

Our operational readiness rate reflects availability of parts. When money is available, we purchase parts from depots for full price and get a quick turn-around. When the money is gone, we wait months for some parts to be repaired and returned. (1)

Frequently, especially phase aircraft. (1)

Tired of getting jumped on for non-availability of parts. Cannibalizing only makes it worse. (1)

Our system from manufacture to Depot to our supply is in dire need of attention. Our gov't needs to open the purse to pay for this equipment so we can keep our pilots current in case of war. (1)

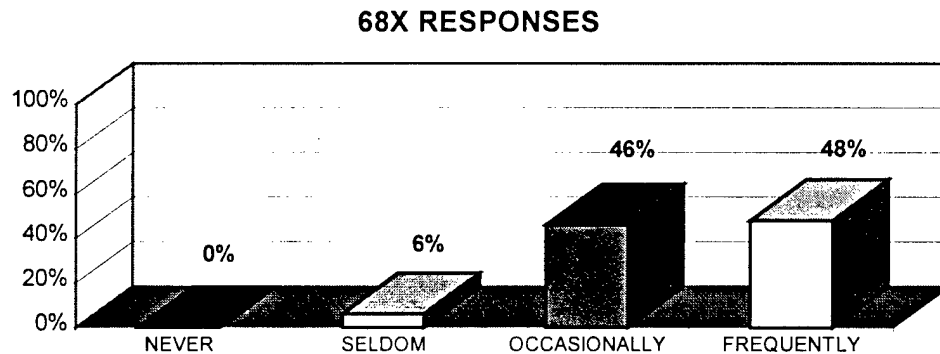
You can't get anything unless it is class IX or AOG. (1)

Parts ordered shouldn't get sent or given to others like guard units, etc. (1)

No money, no parts. (1)

Especially during phases. Sometimes have to order 7 months before. (1)

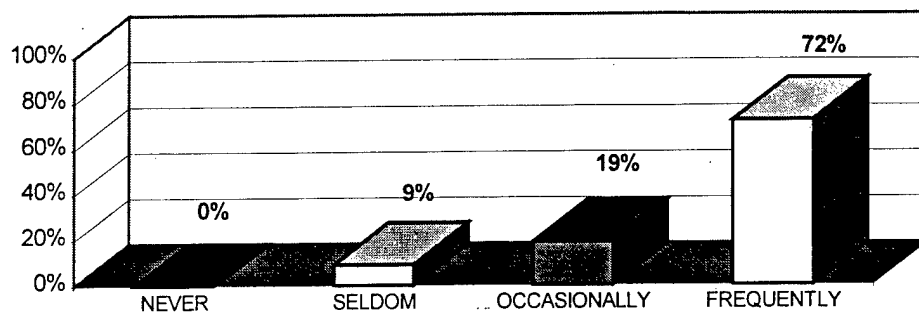
We need a good bench stock - supply takes too long. (1)



## **68X Comments**

No significant comments.

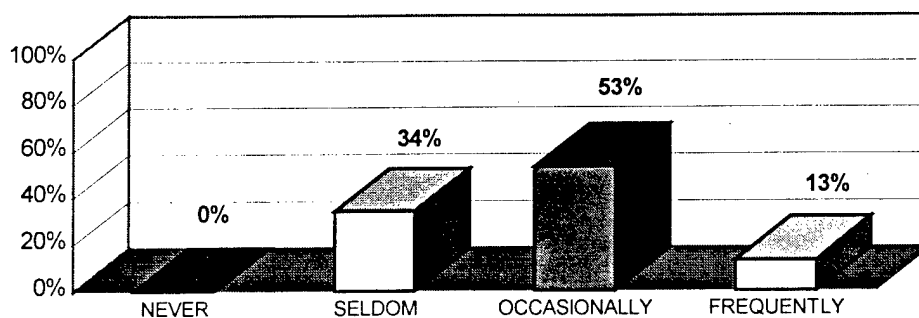
### 68N RESPONSES



### 68N Comments

No significant comments.

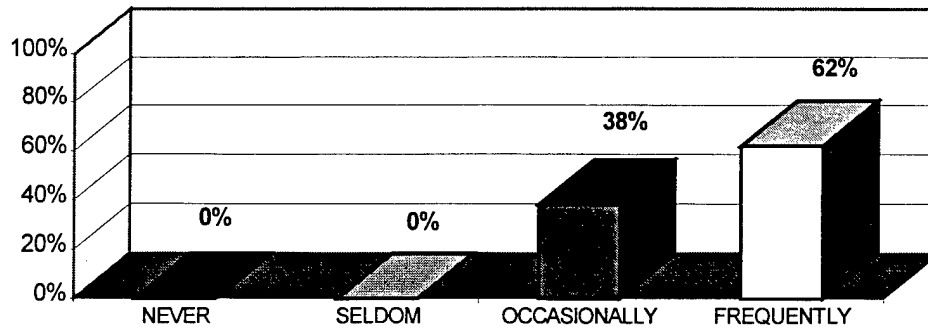
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**RR7. What other types of repair-related tasks do you do most often at AVUM other than removal and replace of components?**

**List types of tasks and any problems you have:**

### 67R Comments

#### Preventive Maintenance Checks and Services: (7 Comments)

Servicing. (3)

Preventative maintenance inspection. (2)

Inspections. (2)

#### Cleaning parts for turn-in: (4 Comments).

Clean parts for turn-in. (4)

### 68X Comments

#### Repairing wires. (10 Comments).

Repairing wires and wire splices - problem with keeping splices on hand. (10)

Voltage - continuity checks. (5 Comments).

Voltage checks - multimeter leads are too short for some things. (3)

Continuity checks - multimeter leads are too short for some things. (2)

**68N Comments**

Wiring repair. (15 Comments).

Wire repair. (4)

Wire splicing. (3)

Wire soldering. (2)

APR-39 wiring repair. (2)

Wire troubleshooting (ICS cables, APR-39 antenna cables

ADF loop antenna and radar altimeter connectors). (2)

Splice replacement. (1)

Soft-splice repairs. (1)

Connector - cable repair. (6 Comments)

Connector repair and replace. (2)

Cable replacing. (1)

Repair ADF connectors. (1)

ICS connections. (1)

Antenna connector replacement. (1)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.



**RR8. List any removal-replace tasks that you perform at AVUM that you feel should be performed by another MOS?**

**List tasks and MOS's:**

**67R Comments**

Engine Removal - Replace Tasks: (4 Comments)

Engine (68B). (4)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

S-39 should be done by 68F personnel. (3 Comments).

S-39 by 68F. (3)

**68D Comments**

No significant comments.

**RR9. What are the most significant improvements that could be made to the AH-64 to reduce the time needed to remove and replace components on the aircraft?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

Need Better Quality Parts: (5 Comments).

Better quality parts. (2)

Need better life times on temperature transducers. (1)

Need better life times on clip detectors. (1)

Need better life times on pressure switches. (1)

Need More Availability of repair parts: (4 Comments)

Having more repair parts on hand. (2)

More tools on hand. (1)

Need more availability of parts. (1)

**68X Comments**

Improve the supply system. (7 Comments)

Need a better supply system. Could save days. (2)

Need supply personnel who are trained in aviation. Could save days. (2)

Make parts more readily available. (2)

Need to get components quicker. (1)

**68N Comments**

Accessibility. (6 Comments)

Relocation of hard to reach parts. (2)

Move the forward APR-39 receiver. (1)

Improve accessibility. (1)

More room in the pilots seat. (1)

An easier way to remove the APR-39 forward receiver. Taking everything off of the aircraft, replacing it, and reinstalling everything takes a good day to day and a half. (1)

**68B Comments**

No significant comments.

**68D Comments**

Perform AVIM tasks at AVUM. (3 Comments)

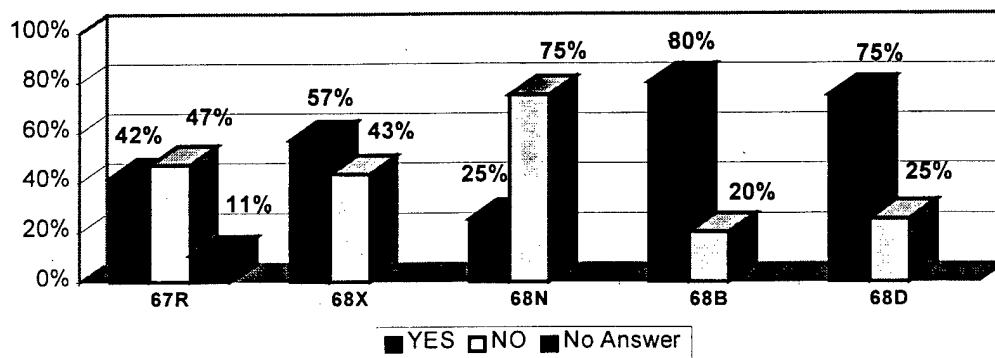
Lots of AVIM tasks can be done by AVUM (less paperwork). (2)

Getting AVIM to do the job can take 3 days while I can get it done in 1 day. Put tasks at AVUM instead of AVIM. (1)

**RR10. Are there any components that are repaired at AVIM that you think should be repaired at AVUM?**

Yes \_\_\_\_\_ No \_\_\_\_\_

**MAINTAINER RESPONSES**



**If yes, list components and why:**

**67R Comments**

**Rotor system components: (10 Comments)**

PC links. (3)  
 Main rotor bearings. (2)  
 Tail rotor head. (1)  
 Fix pitch housing shims. (1)  
 Tail rotor head. (1)  
 Most of the rotor system (1)  
 Scissors. (1)

**Most all tasks: (5 Comments)**

Most work on this airframe can be accomplished at AVUM level if proper tools and parts are available. (3)  
 Other than removal of the main rotor heads, just about all of the maintenance can be done at both levels. (1)  
 Most all. (1)

Canopy Doors: (4 Comments)

Door cables easily done. (2)

Door release handle. (1)

Door latches for the crewstations are usually broken and that is AVUM level maintenance. (1)

**68X Comments**

Aircraft Interface Assembly (AIA). (11 Comments)

Aircraft Interface Assembly (AIA). (10)

AIA replacement. AVUM removes most components anyway. Wastes more time waiting for AVIM to come and do it. (1)

Many or all components should be repaired at AVUM. (9 Comments).

Everything they do, we do a lot better. AVIM should not exist. (5)

All components should be repaired at AVUM. (2)

A lot - too many to list. (1)

Yes. AVIM doesn't have the training or constant hands-on experience to perform even basic AVUM maintenance. How can they be allowed to do more than us. (1)

Azimuth gimbal on 30mm gun turret. (4 Comments).

Azimuth gimbal. (4)

**68N Comments**

No significant comments.

**68B Comments**

G-Axis seals. (8 Comments).

G-Axis seals. (8)

**68D Comments**

Repairing seals. (5 Comments).

Seals - less time consuming not having to wait for AVIM. (3)

Magnetic seals on drivetrain gearboxes - we did those for years with no problem - not we have to get a work order and it takes 2 - 3 times longer. (1)

Nose gearbox output seal. (1)

**RR11. If you have any other problems or comments relating to removing and replacing AH-64 components, please describe them here:**

**67R Comments**

**Supply Problems: (4 Comments)**

Parts purchased for full face value - TADS-PNVS when a small subcomponent is replaced at Depot - millions of dollars are gone. (1)

Give us the capability to repair or have TADS-PNVS systems repaired and returned expediently. This would greatly improve the situation. (1)

Biggest problem is supply turn-in. For every one hour I spend installing a part, it takes just as long to turn-it in. (1)

Some class 9 items are ordered often but not stocked at state level - ASL. (1)

**68X Comments**

No significant comment.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

**Improve generator driveshaft. (3 Comments).**

Charge the generator drive adapter plastic. (1)

Make the generator shaft fit the splices. (1)

Design generator driveshaft to shear if a problem exist. (1)

## OPERATIONAL CHECKS

**OC1. Which components are the most difficult to perform operational checks on?**

**List components and describe problems:**

### 67R Comments

Hydraulic system: (4 Comments)

Hydraulic MOC is too long. If I replace a filter or hand pump, it requires 2 hours of MOC. (1)

Hydraulic MOC - when I replace an "o" ring on the hand pump. (1)

Hydraulic system MOC is too long if replacing just one component. (1)

Hydraulic system - 35 pages. (1)

### 68X Comments

Problems with maintenance operational checks on HELLFIRE missiles. (16 Comments).

Maintenance operational checks on missiles are difficult. (6)

HELLFIRE MOC is vague. (5)

Missile MOC in book is slightly confusing. (4)

RHE inaccurate reporting to bus. (1)

Problems with maintenance operational checks on 30mm gun. (7 Comments)

Area weapon system (30mm gun). (3)

Gun MOC. (2)

Gun MOC takes too long. (1)

Feed system. (1)

### 68N Comments

Doppler. (12 Comments).

Doppler (too many steps). (12)

HARS. (8 Comments)

HARS (ASN-43). (8)

Video recorder. (4 Comments).

Video recorder. (4)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**OC2. List any operational checks you perform at AVUM that you feel should be performed by another MOS?**

**List operational checks and MOS:**

**67R Comments**

No significant comments.

**68X Comments**

Stabilator MOC should be performed by 67R. (6)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**OC3. What are the most significant improvements that could be made to the AH-64 to reduce the time needed to perform operational checks on the aircraft?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

Maintenance operational checks should be more specific and less time-consuming: (10 Comments).

A lot of time is spend doing unnecessary MOC's.(2)

Some MOC's are silly, frustrating and time-consuming. We want to change what we know is wrong but systemic requirements cripple us. Not in all instances, but there should be more initiative allowed. (1)

TM's restrict the mechanics to a fixed procedure to isolate the problem. (1)

Some of the checks could or should be abbreviated as some components are not touched yet MOC's call for certain checks. (1)

Reduce the length of MOC tasks to the essentials. Make troubleshooting separate. (1)

Many times an MOC is required when basically nothing was done except removing a bolt or disconnecting and its not even related to an MOC. Should review reason for MOC.(1)

Reduce repetition. (1)

MOC's should more task specific and not so general. (1)

You do complete system MOC's on simple repairs - e.g., hydraulic filter - why not just a leak check and a bleed?(1)

**68X Comments**

Improve the FDLS. (4 Comments).

Acft should automatically run FDLS when it starts and display everything wrong. (100% check). (2)

Expand the FDLS. (1)

Incorporate more BIT. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.



**68D Comments**

No significant comments.

**OC4. If you have any other problems or comments related to performing operational checks on the AH-64 components, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## PERIODIC AND PHASE INSPECTION

**IN1. Which components are the most difficult to inspect at AVUM?**

**List components and describe problems:**

### 67R Comments

#### Auxiliary Power Unit (APU): (11 Comments)

APU mounts. (5)

PTO clutches. (4)

APU. (1)

APU mounts - APU must be removed to inspect the mounts. (1)

#### Main Rotor Components: (6 Comments)

Main rotor head. (3)

Main rotor strap packs. (2)

Main rotor head - because of lack of parts to maintain. (1)

#### Environmental Control Unit (ENCU): (5 Comments)

ENCU lube. (3)

ENCU turbine lube - its difficult to get to and safety the caps on. (1)

ENCU due to location. (1)

### 68X Comments

#### 30mm gun system components. (5 Comments)

30mm feed system. (2)

Gun. (1)

Gun is time-consuming to grease and degrease. (1)

Gun barrel. (1)

#### TADS-PNVS. (4 Comments)

TADS. (2)

PNVS. (2)

### 68N Comments

#### APR -39. (5 Comments)

Periodic inspection of the APR-39 system. Too many panels. (2)

APR-39 receivers location.(2)

All ASE. (1)

### 68B Comments

No significant comments.

### 68D Comments

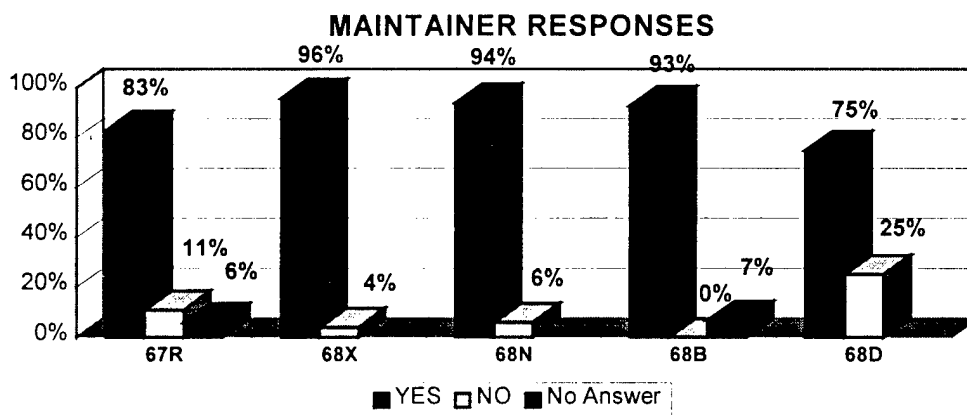
#### Main rotor components. (4 Comments).

Main rotor strap pack (requires flexible borescope). (2)

Main rotor hubs - they are so detailed and have so many different parts. (2)

**IN2. Is the format of DA Forms 2408 - 13/14 easy to follow and understand for recording problems with the aircraft?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, explain problems:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

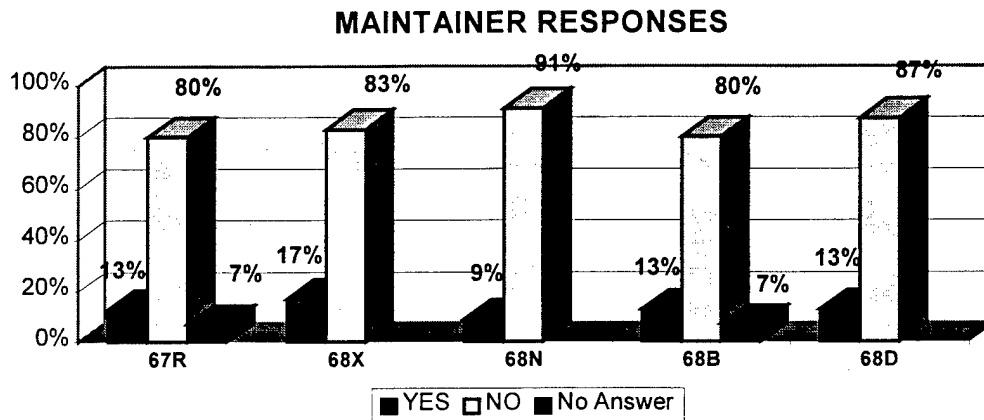
No significant comments.

**68D Comments**

No significant comments.

IN3. Are there any information blocks you feel need to be added to DA Forms 2408 - 13/14?

Yes \_\_\_\_\_ No \_\_\_\_\_



If yes, list information blocks:

**67R Comments**

Add More Information Blocks: (4 Comments)

Additional pages like the 2408-13-1 and 2408-13-2 for related maintenance. (1)

Add aircraft time to the -14. (1)

More blocks per pages. (1)

More boxes in block #10. (1)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

### 68B Comments

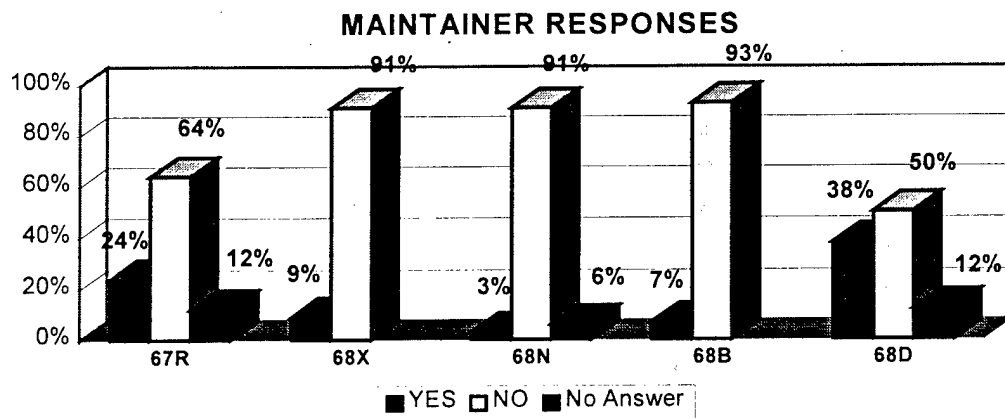
No significant comments.

### 68D Comments

No significant comments.

**IN4. Are there any safety-of-flight parts that are difficult to inspect in a thorough manner?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list safety-of-flight parts:**

### 67R Comments

Main Rotor System: (12 Comments)

Strap packs (main rotor). (11)

Main rotor blades. (1)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

**Main rotor parts. (3 Comments).**

Main rotor head strap pack with borescope. Better off taking off the lead-lag link assembly. (1)

Main rotor hub subassembly. (1)

Main rotor head strap pack. (1)

**IN5. List any inspection tasks you perform at AVUM that you feel should be performed by another MOS?**

**List tasks and MOS's:**

**67R Comments**

**Main Rotor System: (7 Comments)**

Main rotor strap pack borescope by 68D's. (5)

Main rotor blades. (2)

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

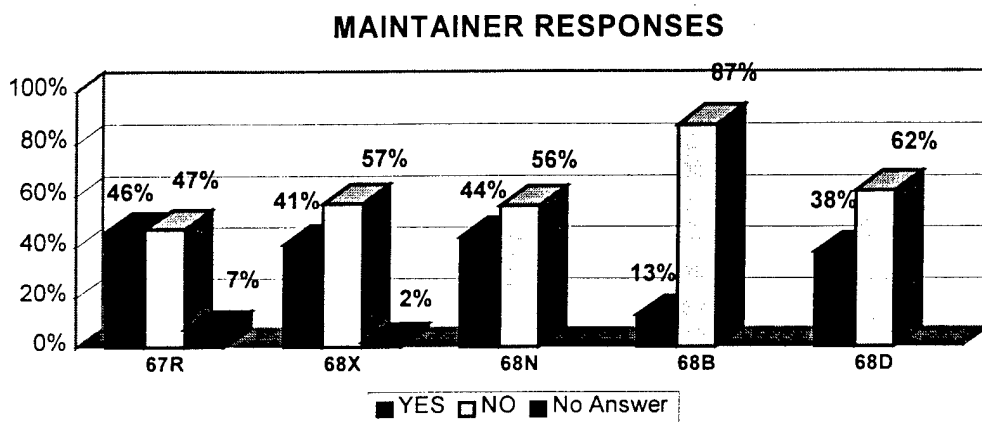
No significant comments.

### 68D Comments

No significant comments.

**IN6. Do you need any cleaning supplies or fluids not provided to you at AVUM to perform inspection tasks on the components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list cleaning supplies and fluids:**

### 67R Comments

#### Cleaning Fluids: (18 Comments)

Cleaners for TADS-PNVS and windows. (3)

The old trichlorotrifluoroethane - the stuff that is not biodegradable - the acft soap that really cuts thru dirt and oil (the old stuff - it really worked well). (2)

Avionics cleaner. (2)

All purpose cleaner-degreaser. (2)

Alcohol for the ALQ-144. (2)

Denatured alcohol. (1)

Citrus based engine cleaner - non-toxic and it cleans good. (1)

Engine wash. (1)

Substitute for trie. (1)

Soap (real soap, not the Army cutback soap). (1)

Acft surface soap. (1)



We need a better list of alternatives that can be used in lieu of trichlorotrifluoroethane. (1)

**68X Comments**

Need alcohol. (4 Comments).

Alcohol for the TADS lenses. (2)

Alcohol. (2)

Need trichlorotrifluoroethane. (4 Comments)

Need trichlorotrifluoroethane. (4)

Need trichlorotrifluoroethane. (4)

Need POL products. (4 Comments)

Need POL products. (4)

**68N Comments**

Avionics. (9 Comments).

Avionics cleaner. (9)

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**IN7. What are the most significant improvements that could be made to the AH-64 to reduce the time needed to perform inspections on the aircraft?**

**List improvements and amount of time you think it would reduce:**

**67R Comments**

Provide better access for inspection of components: (8 Comments)

- Adding more access panels. (1)
- Adding more maintenance platforms. (1)
- Better access to driveshaft. (1)
- Better access to APU. (1)
- Make the tail rotor gearbox easier to remove. (1)
- Anti-flail bearing on APU driveshaft takes awhile to remove due to location (every 125 hours).(1)
- Tailboom access. (1)
- Access panel to inspect the primary exhaust. (1)

Provide more tools and parts: (5 Comments).

- Need more parts. (2)
- Provide a torque wrench with the general mechanics tool box. (1)
- Provide sockets corresponding to the 10 hour-14 day maintenance tasks for mechanics. (1)
- Tool truck per company. (1)

**68X Comments**

Need an armament phase book. (6 Comments).

- Need an armament phase book. It would save days of work. (4)
- Phase book 1-1520-238-PM needs armament inspection included in it. Get rid of 200 page flt pack for phase completion. Go back to book for phase - not a phase book and logbook. (1)
- Phase book should include armament and electrical tasks. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**IN8. If you have any other problems or comments relating to inspection of AH-64 components, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

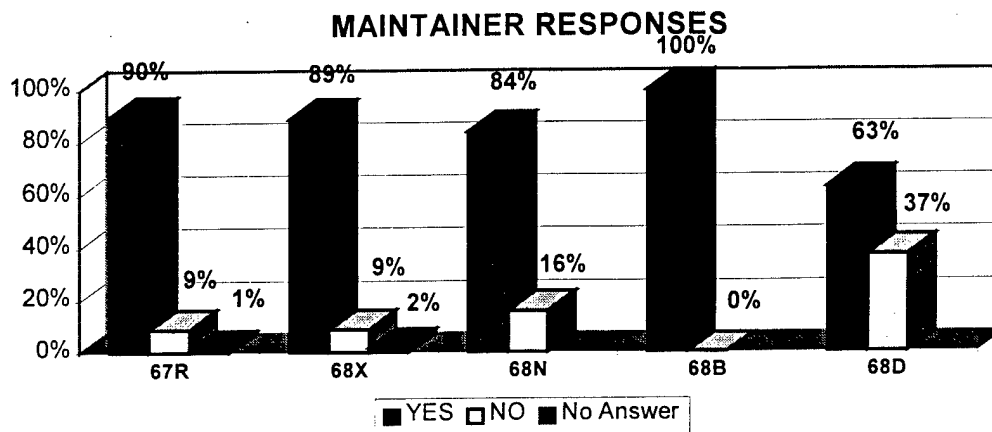
**68D Comments**

No significant comments.

## TECHNICAL MANUALS

**TM1. Is the format of the technical manuals easy to follow and understand for servicing and removing-replacing of components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, describe specific problems:**

### 67R Comments

No significant comments.

### 68X Comments

No significant comments.

### 68N Comments

No significant comments.

### 68B Comments

No significant comments.

## **68D Comments.**

### **Problems with technical manuals. (5 Comments).**

Tasks are hard to find. (1)

Tasks are too general. (1)

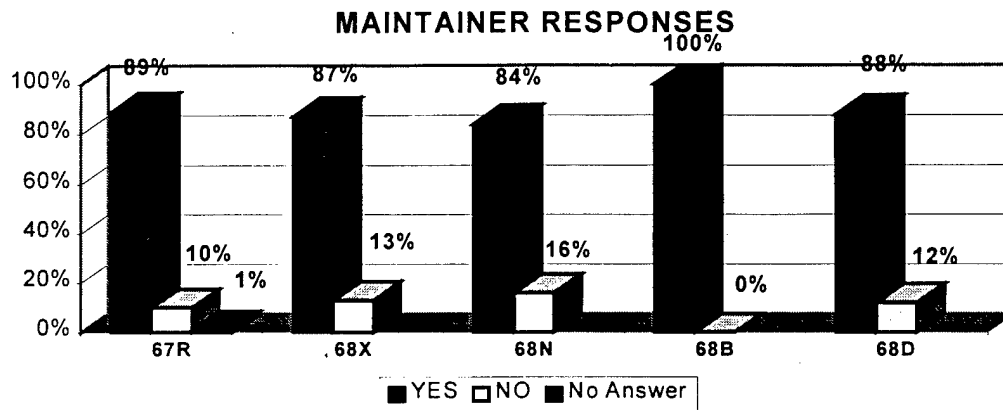
Tasks require special tools that aren't listed. (1)

Main rotor hub parts listed in flight control section, but repair criteria listed in rotor section. (1)

Need to be more specific at the beginning of tasks on what should already be removed. (1)

**TM2. Is the information in the technical manuals adequate for servicing and removing-replacing of components?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, what information is inadequate?**

## **67R Comments**

### **Need Additional Information: (8 Comments)**

Torque's from the 204 manual should be in our book, including torque values, hydraulic lines, etc. (2)

Need more information. (2)

Need more detail. (2)

When TM was re-invented to put a number 1 instead of SS, they neglected to add several tasks, e.g., tail rotor hub removal disassembly and assembly. (1)

Inspection criteria for use of each fastener. (1)

### **68X Comments**

No significant comments.

### **68N Comments**

#### **More information needed in TM's. (5 Comments)**

System descriptions need to go into greater detail. (1)

Information in TM's is not adequate for all systems. Too many variables on some systems (HARS, DASE). (1)

FDLS needs to have all of its codes stated in the manual. (1)

Need more in-depth information on precise functions of components. (1)

Wiring diagrams need wire numbers. (1)

### **68B Comments**

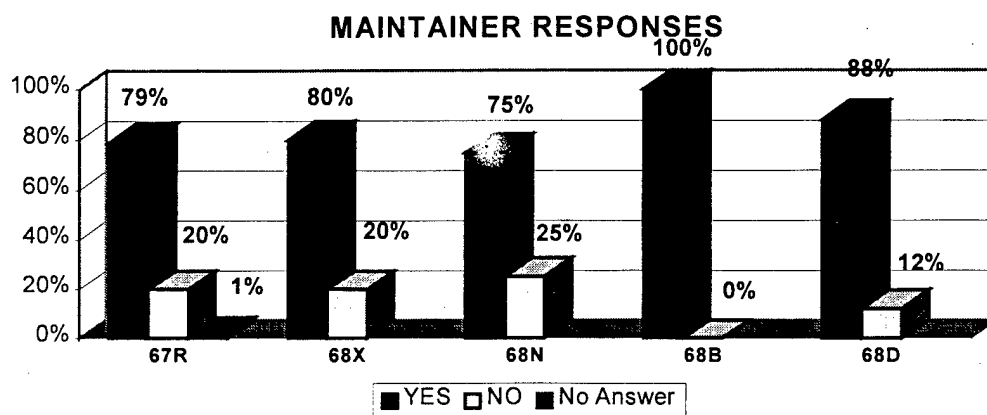
No significant comments.

### **68D Comments**

No significant comments.

**TM3. Are diagrams of the components in the technical manuals easy to understand?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, which diagrams are unclear?**

#### **67R Comments**

Need more accurate and in-depth diagrams: (10 Comments)

Some diagrams are not accurate. (2)

They never are easy to understand. (2)

Need more in-depth description. (1)

Some are unclear. (1)

Just do not do maintenance by the picture - the picture is not right a lot of the time, e.g., shims, washer stack-up, etc. (1)

We have come across quite a few parts in the manual that the part numbers are not good or aren't on the system. (1)

Diagrams and text never agree. (1)

Need extended versions of diagrams for better reference. (1)

#### **68X Comments**

Improve wiring diagrams. (5 Comments)

Wiring diagrams don't always match those in other books. (2)

Wiring diagrams need to be done a whole lot better. (2)

Make a schematic of each component with the I.O.'s listed. (1)

### **68N Comments**

Diagrams need improvement. (10 Comments).

Diagrams are too spread apart. (2)  
Too much time spent searching for all related diagrams. (2)  
The TM's jump around and are confusing. (1)  
Each system needs to have its own diagram. (1)  
Too many dead ends. (1)  
Wrong diagrams. (1)  
All diagrams are difficult for me. (1)  
Don't combine diagrams. (1)

### **68B Comments**

No significant comments.

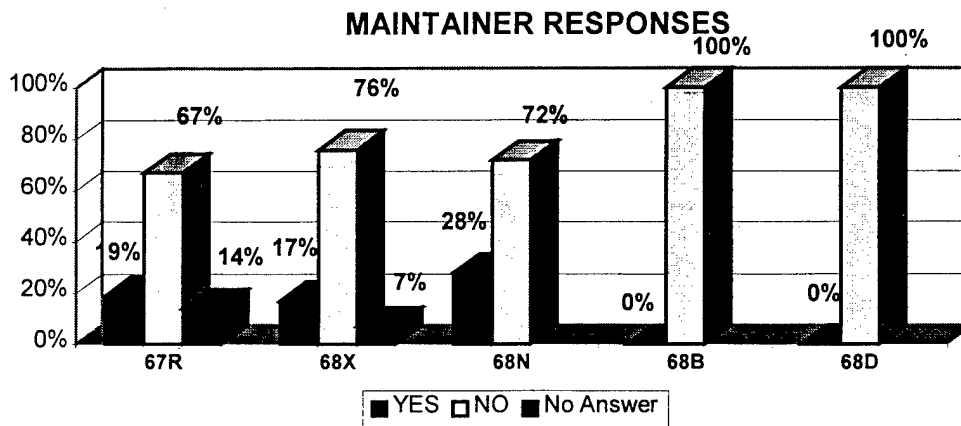
### **68D Comments**

No significant comments.



**TM4. Are there any components that do not have diagrams illustrated in the technical manuals?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, which components?**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

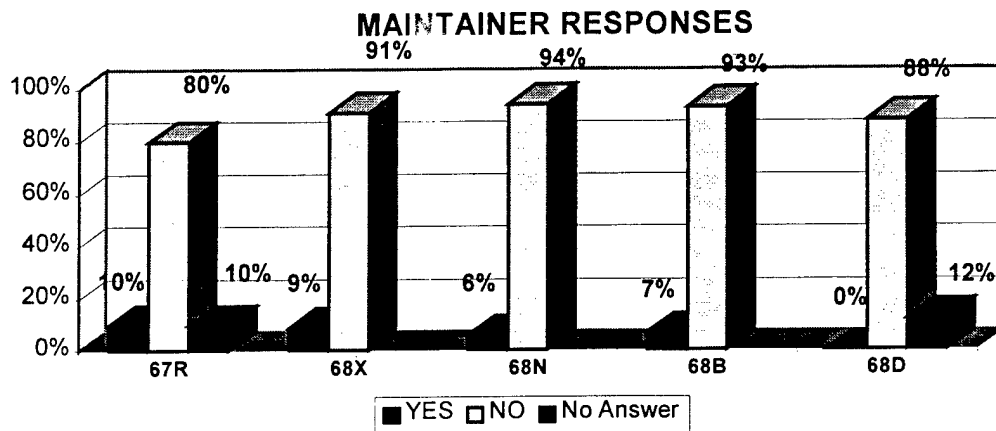
No significant comments.

**68D Comments**

No significant comments.

**TM5. Are there any safety warnings or cautions that need to be included in the technical manuals?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, what safety warnings or cautions?**

#### **67R Comments**

##### Auxiliary Power Unit (APU): (1 Comment)

APU could start even when the breakers are pulled out. If the battery is on or external power is on and the starter switch is set to start. (1)

##### Rotor Brake (1 Comment)

When doing an engine wash, there is point where the rotor brake should be put on and the book doesn't say so. (1)

#### **68X Comments**

No significant comments.

#### **68N Comments**

No significant comments.

### 68B Comments

No significant comments.

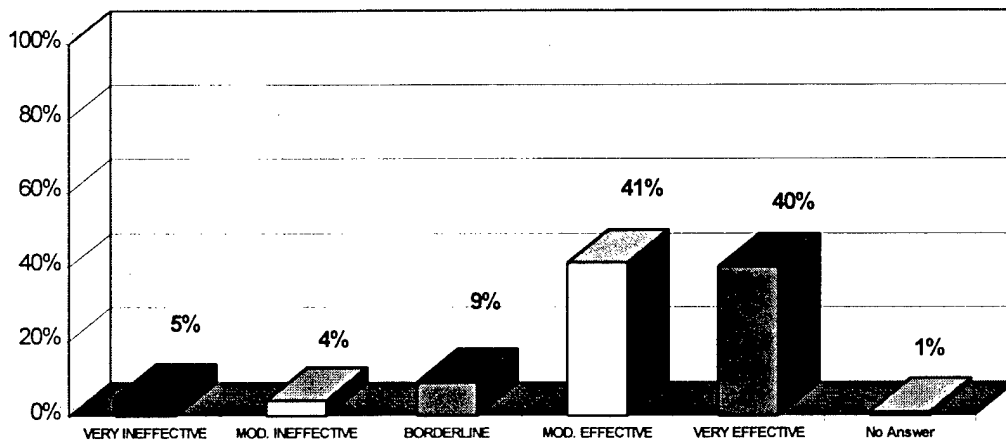
### 68D Comments

No significant comments.

**TM6. How effective are the safety warnings and cautions in the technical manuals for preventing safety problems during maintenance? (Circle one)**

5	4	3	2	1
Very Ineffective	Moderately Ineffective	Borderline	Moderately Effective	Very Effective

**67R RESPONSES**



### 67R Comments

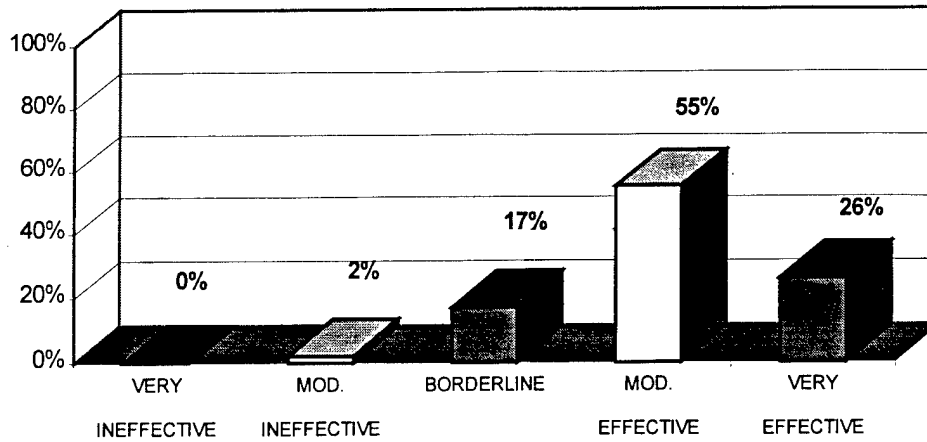
Need to highlight cautions and warning more than they currently are: (4 Comments).

Need to color code warnings and cautions.(2)

Need to make cautions and warnings bigger. (1)

Warnings and cautions should be highlighted. (1)

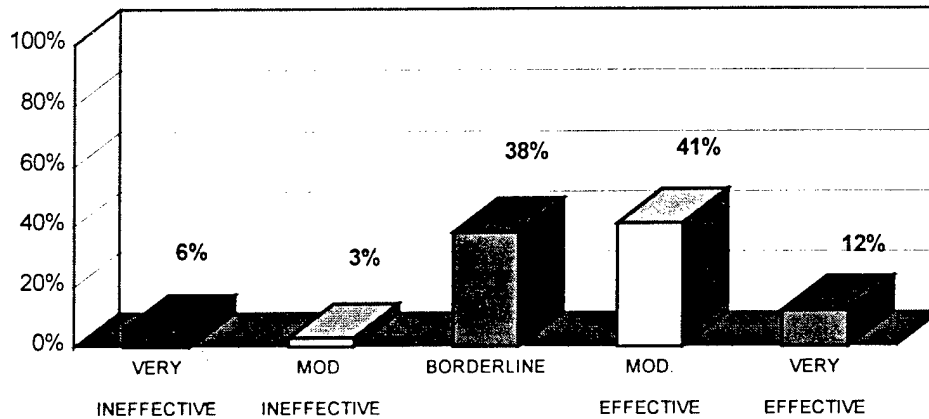
### 68X RESPONSES



### 68X Comments

No significant comments.

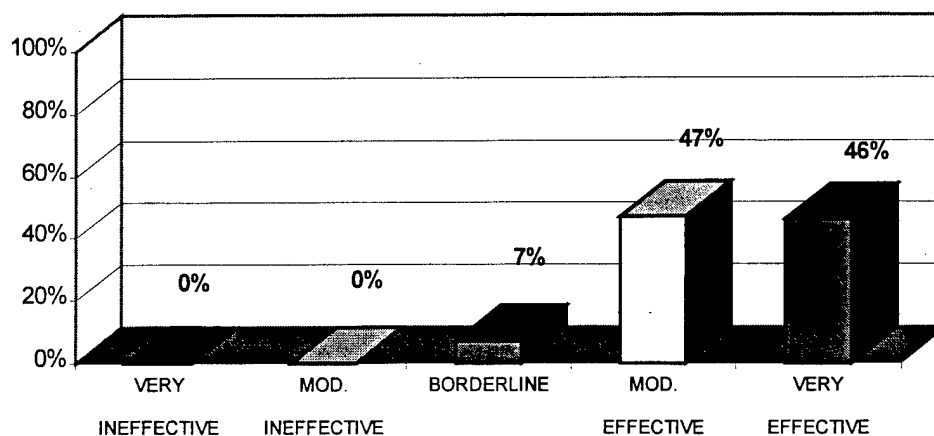
### 68N RESPONSES



### 68N Comments

No significant comments.

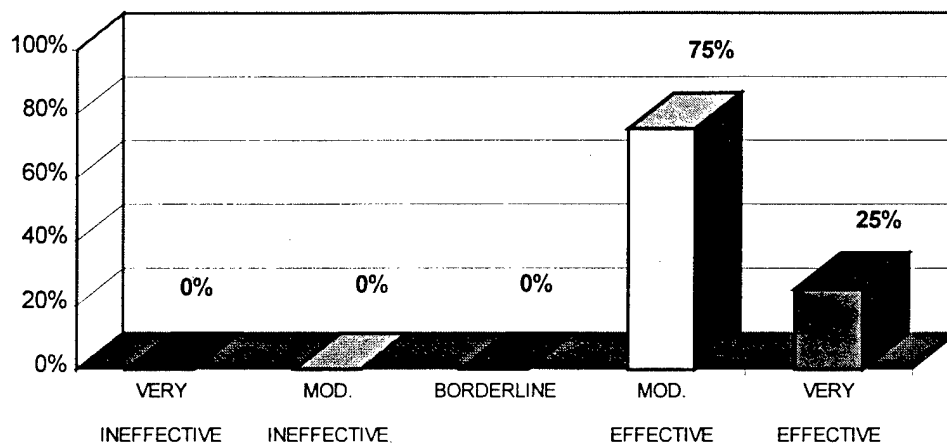
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

**TM7. List any components or equipment that is not correctly identified in the technical manuals?**

**List which components or equipment:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

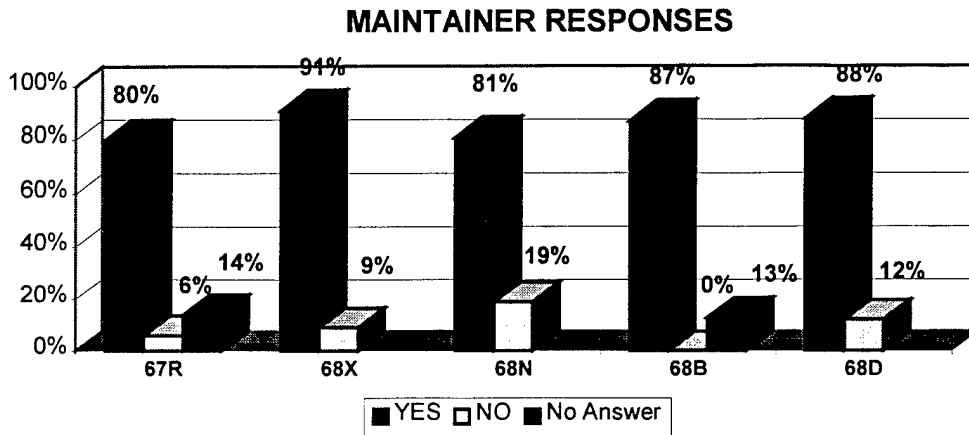
No significant comments.

**68D Comments**

No significant comments.

**TM8. Are weight limitations for all components that require two personnel or more to lift and carry listed in the technical manuals?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If no, list which components:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

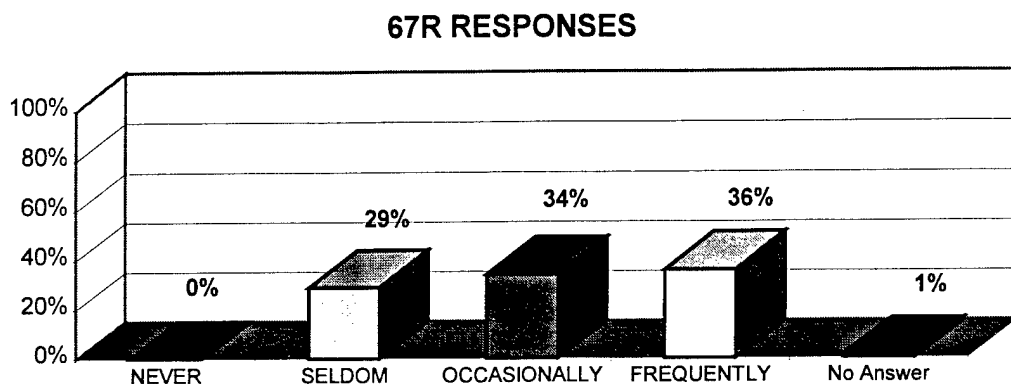
No significant comments.

**68D Comments**

No significant comments.

**TM9. How often do you experience problems finding an adequate location to place your technical manual for reading while working on the aircraft?  
(Check one)**

**Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_**



**Describe problems you have:**

#### **67R Comments**

No good place to put technical manual while working on aircraft: (22 Comments).

No place to put it when working on the main rotor head. (6)

Pages rip out easily and its hard to have a book with you on the acft - no place to put it. (4)

Frequently have problems - most work is done outside and where do you put it? (3)

Catwalk is the only place you can read the book. (2)

I just put in around my work area or on the floor, especially when I'm working on the tail rotor blade and tailrotor swashplate. (1)

Need a work bench. (1)

You have to stand where the book is. (1)

No place to put it while working on tail rotor head. (1)

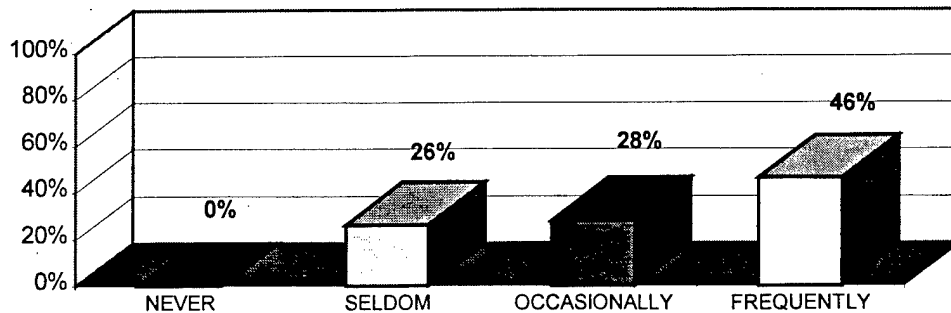
The TM usually goes on the maintenance stand during tail rotor maintenance (safety hazard). (1)

During constant operational checks and flight operations. (1)

Problem is even worse unless you tie the catwalk panel with a bungee cord (it hits you on the side of the head). (1)



### 68X RESPONSES



### 68X Comments

#### Wind. (9 Comments)

Pages blow in the wind. (7)

When you place book on FAB and wind blows, the book gets torn up. (1)

The other aircraft around you always blow pages out or around. (1)

#### No place to put TM while working on the aircraft. (7 Comments).

No place to put TM while in the cockpit. (4)

Most of the time, it ends up on the ground. Flight line compounds the problem. (1)

The aircraft is not a desk. (1)

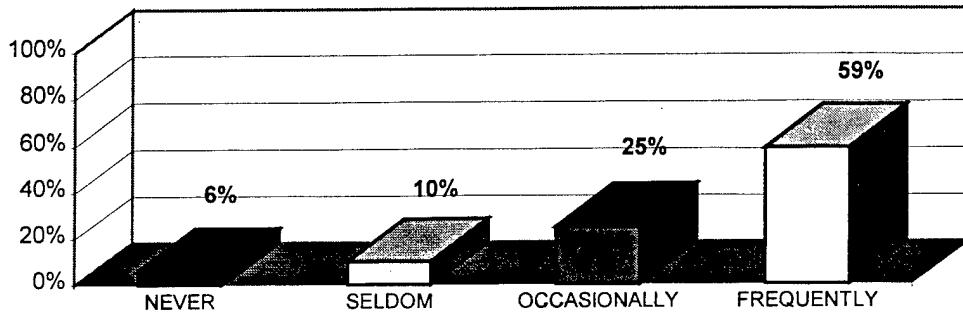
Bulkiness of TM's. (1)

#### Weather is a problem. (4 Comments).

Weather. (2)

Rain. (2)

### 68N RESPONSES



### 68N Comments

No room or place to lay manuals. (9 Comments).

Not enough room (4)

No place to lay manuals and still be able to read them, especially in cockpit areas.

(2)

No room for FIP's in the cockpits. (1)

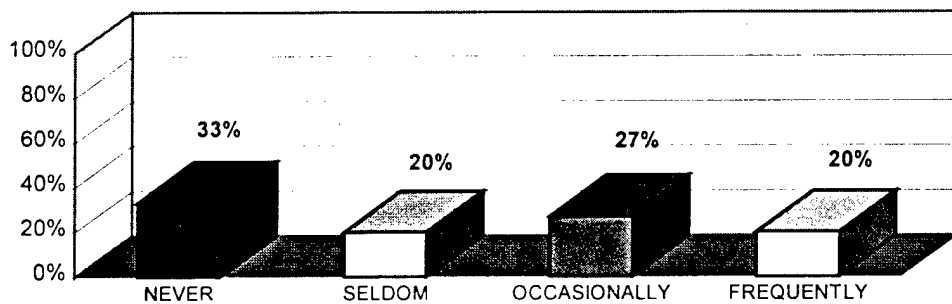
You don't do both at the same time - the book stays on a table or on the ground. (1)

Using wiring diagrams while seated in the front or back seat. (1)

Wind. (4 Comments)

Wind. (4)

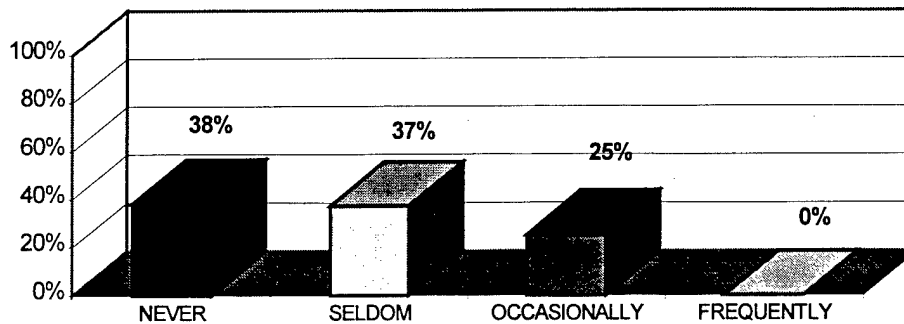
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



#### 68D Comments

No significant comments.

**TM10. What are the most significant improvements that could be made to the technical manuals to reduce the time needed to perform maintenance on the aircraft?**

**List improvements and amount of time you think it would reduce:**

#### 67R Comments

No significant comments.

#### 68X Comments

Need a lap-top computer. (9 Comments)

Computerize them on laptop PC's (Could save 50% of time). (5)

Need a small lap-top computer with all tech data and MOC's. (4)

Need better index-table of contents. (4 Comments).

Better index on how to find components would save hours. (2)

Need better table of contents. (1)

If a manual has more than one book (such as the 9-1090-208-23-1-1), there should be an index in both books. (1)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

List NSN and part #'s together on the same pages. ( 3 Comments).

List NSN and part #'s together on the same pages. (3)

**TM11. If you have any other problems or comments relating to the content of the technical manuals that were not addressed, please list them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## **TRAINING**

**TN1. What areas of training (e.g., theory, hands-on) for maintenance of aircraft components needs to be improved?**

**List specific areas and problems:**

### **67R Comments**

Need more hands-on training: (6 Comments)

Need more hands-on training. (6)

Need more training with FDLS (6 Comments)

More cockpit time for hands-on with FDLS with external power. (2)

Hands-on with FDLS. (1)

Read codes. (1)

Need more aircraft systems theory training: (4 Comments)

More training in aircraft systems theory. (4)

### **68X Comments**

Need to improve hands-on training. (6 Comments).

Need to improve hands-on training. (6)

### **68N Comments**

Need additional theory and operations. (4 Comments).

How the systems work together. (2)

Basic electronics troubleshooting. (1)

Theory. (1)

### **68B Comments**

No significant comments.

### 68D Comments

Need more hands-on training. (4 Comments).

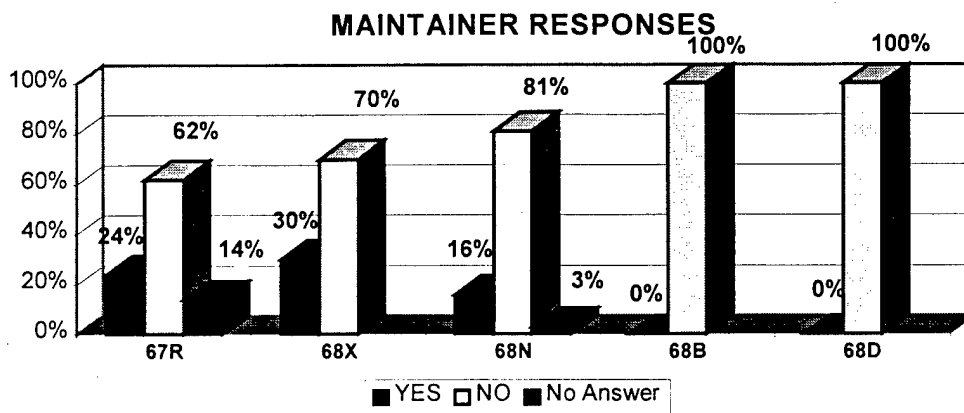
Need more on-the-job (hands-on) training. (2)

Hands-on training on transmission (1)

Hands-on training on main rotor head. (1)

**TN2. Were there any areas of training you were given that you later found to be wrong?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, what training was wrong?**

### 67R Comments

No significant comments.

### 68X Comments

No significant comments.

### 68N Comments

No significant comments.

### 68B Comments

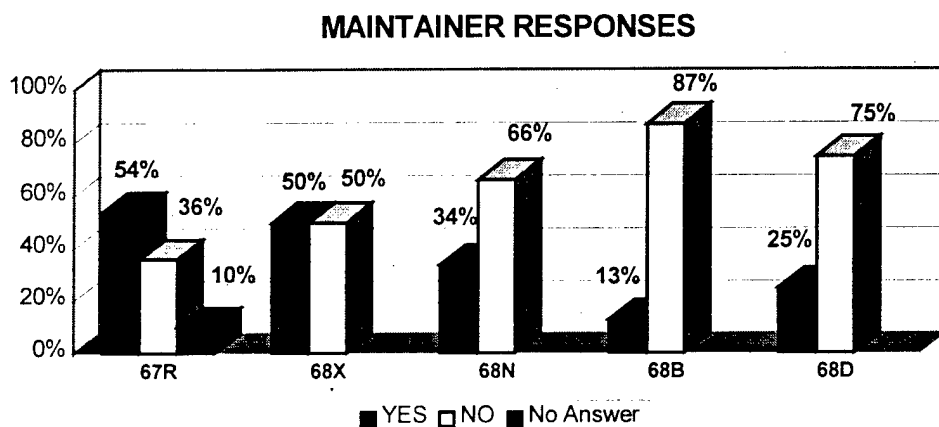
No significant comments.

### 68D Comments

No significant comments.

**TN3. Have you found an easier way to perform a particular task compared to the way you were trained to perform that task?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, which tasks are now easier and how did you make them easier?**

### 67R Comments

Have found an easier way for many tasks: (7 Comments)

Too many. (2)

Don't have to remove parts as tasks suggest. (2)



Too many to list. (1)

Lots. (1)

Most tasks have unnecessary steps which can be omitted. (1)

#### **68X Comments**

Many or all tasks. (6 Comments).

Everything. (2)

Lots. (2)

Hundreds of times. (1)

Come see me and I'll show you. I ain't got all day to spend writing about the improvements I've made to this ancient technological aircraft. (1)

#### **68N Comments**

No significant comments.

#### **68B Comments**

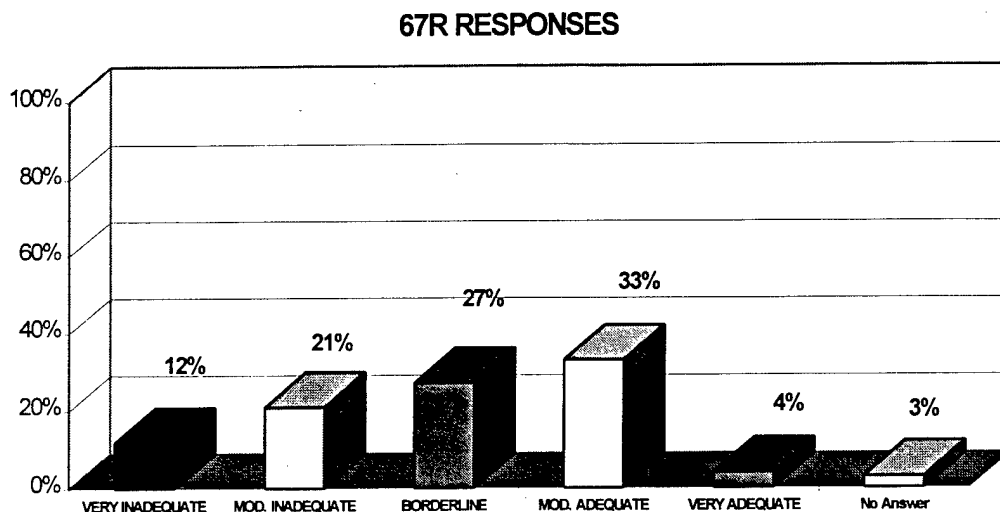
No significant comments.

#### **68D Comments**

No significant comments.

**TN4. Rate the adequacy of training you have received for maintenance of aircraft components at the schoolhouse for the AH-64. (Circle one)**

5	4	3	2	1
Very Inadequate	Moderately Inadequate	Borderline	Moderately Adequate	Very Adequate



### **67R Comments**

#### Training rated as Very Inadequate: (8 Comments)

Shown how to use books - instructors had no clue of actual maintenance of aircraft.

(1)

Instructors were reading out of training outlines. Some weren't even MOS qualified, just passing through until their next Army assignment. (1)

They only teach component and component function, not maintenance and inspection procedures. (1)

Not much is taught at AIT. (1)

The component description helped but hands-on was poor. (1)

Don't actually work on real flyable aircraft. (1)

No training on finding faults. (1)

I learned nothing at school. (1)

Training rated as Moderately Inadequate: (4 Comments).

You learn with hands-on experience. (1)

When I went through school, the instructors never actually worked on an Apache.  
(1)

I think that the course 10 level at Fort Eustis should teach 10 hour-14 day  
inspection by the book just to give the student a heads-up before he gets to the  
unit. (1)

They did not give you enough hands-on training. (1)

Training Rated as Borderline: (7 Comments)

School introduced us to aircraft. Company showed us how to work on it. (2)

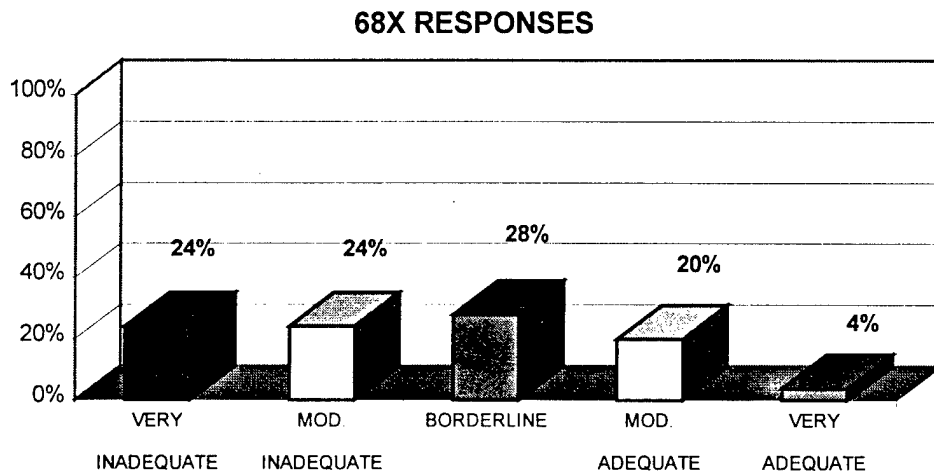
You learn with hands-on experience. (1)

They only teach component and component function, not maintenance and  
inspection procedures. (1)

Schoolhouse does not ever have a pilot to run up acft for MOCs. (1)

Borderline - covered the basics. (1)

Borderline - need more training. (1)



**68X Comments**

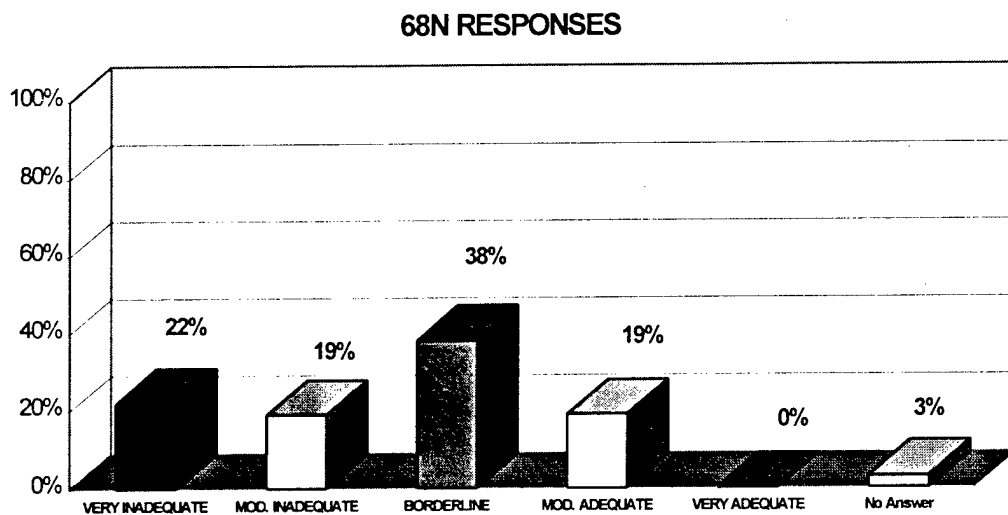
Problems with training at schoolhouse. (23 Comments).

Need better hands-on rather than just running MOC's (3)

Need more time on common tasks other than B.S. tasks.(2)

Did not prepare except for location of components. (2)

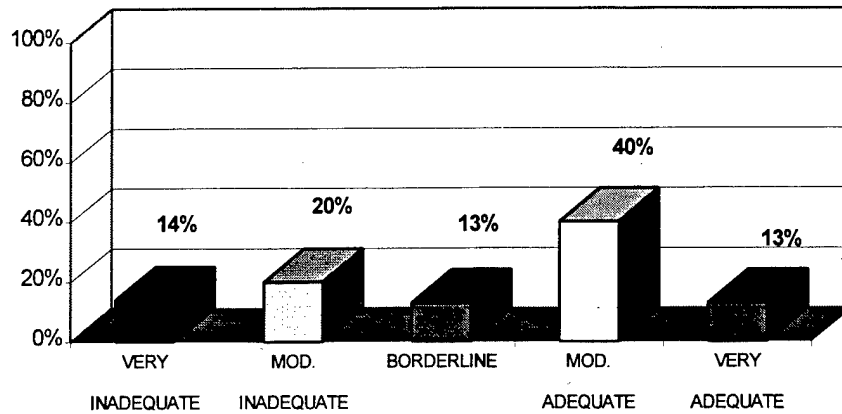
"You don't need to know that, you'll find out when get to your unit" - Common statements you hear during training. (1)  
 I question the amount of theory given to a -10 level soldier with no experience. This soldier should be able to R and R and identify components. Not tell me how many and what CCA's are in it. (1)  
 Too much time doing other things than going to school (1)  
 I learned absolutely nothing about my current job at Fort Eustis. (1)  
 Need a little more time on electrical work. (1)  
 Need more tests on actual problems. (1)  
 Drifted to areas not involved with my MOS. (1)  
 Instructors do not have first hand AVUM experience and teach only from the book. (1)  
 No understanding of aircraft. (1)  
 No knowledge of location of components. (1)  
 No idea how to do most services. (1)  
 Needs better electrical training. (1)  
 We were not allowed to actually conduct maintenance at my AIT. (1)  
 You only learn 5% of what you need to know. (1)  
 School and job are totally different. (1)  
 Training dealt with familiarization, not actual troubleshooting or maintenance. (1)



### 68N Comments

No significant comments.

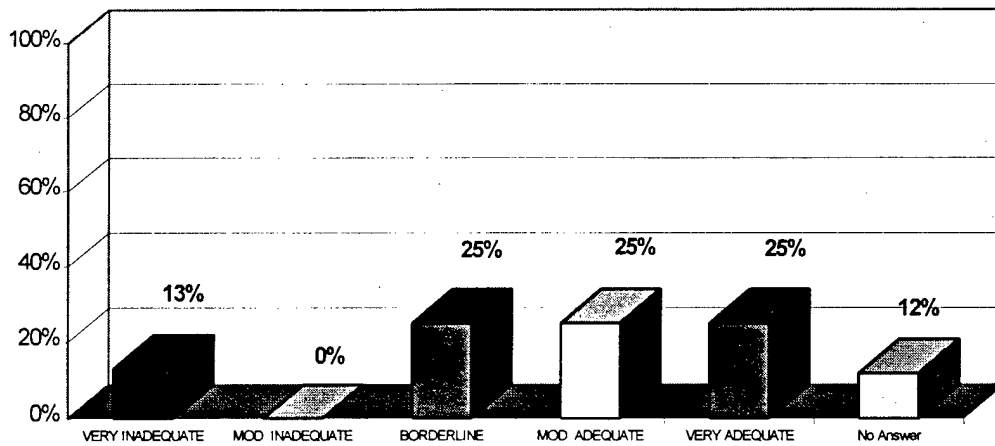
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



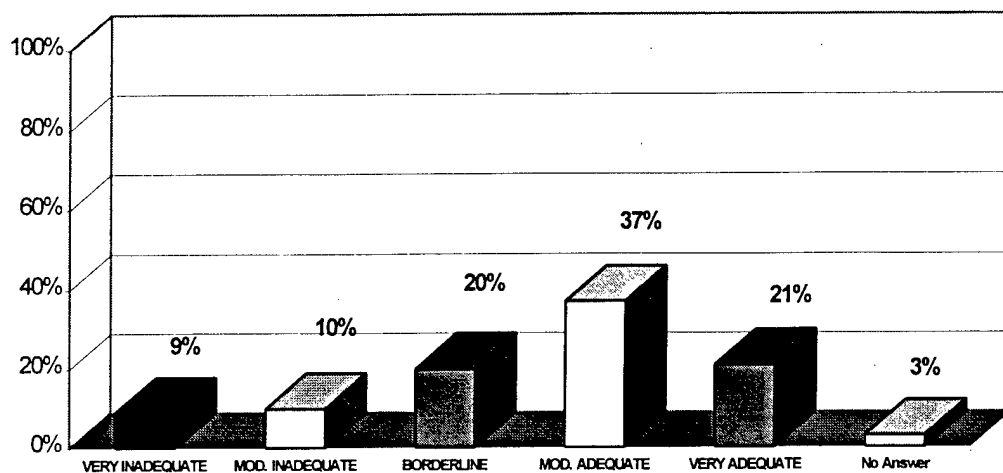
### 68D Comments

No significant comments.

**TN5. Rate the adequacy of training you have received for maintenance of aircraft components at the unit level for the AH-64. (Circle one)**

5	4	3	2	1
Very Inadequate	Moderately Inadequate	Borderline	Moderately Adequate	Very Adequate

**67R RESPONSES**



### **67R Comments**

#### Training rated as Very Inadequate: (4 Comments)

Needs more supervision. Fortunately, most of our unit has prior experience. (1)

Learned on my own. (1)

None received. (1)

We didn't get any acft training at unit level. (1)

#### Training rated as Borderline: (4 Comments)

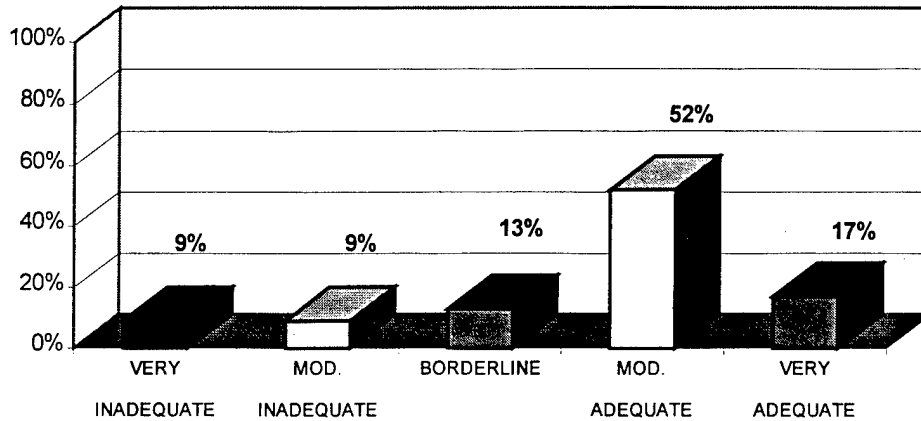
Needs more supervision. Fortunately, most of our unit has prior experience. (1)

Forms and records were the biggest failure. The T.I.'s taught me. (1)

We didn't get any acft training at the unit level. (1)

Unit has no time to train properly due to our weekend duties. (1)

### 68X RESPONSES



### 68X Comments

Problems with training at the unit level. (7 Comments).

No training - just learning from experienced soldiers. (2)

You bust your head against the wall until you figure it out. (1)

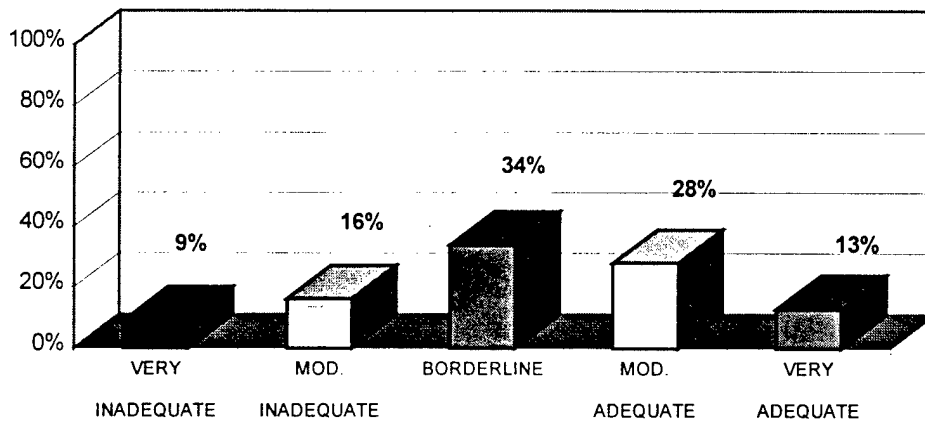
No training - they expect you to learn on the run. (1)

Involves work we never do. (1)

Most training is doing by troubleshooting on your own. (1)

Self-taught through the manuals. (1)

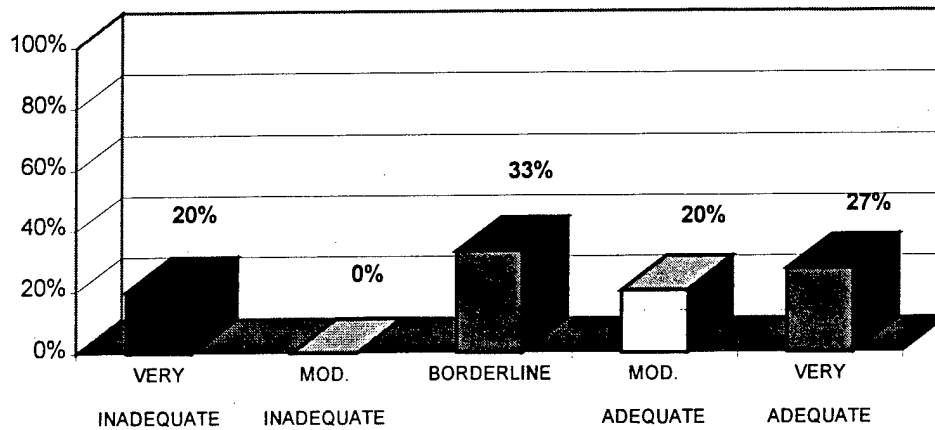
### 68N RESPONSES



### 68N Comments

No significant comments.

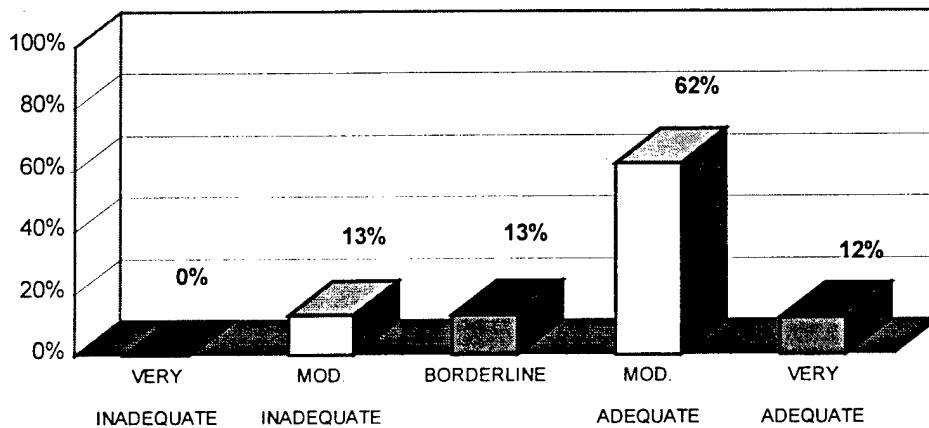
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

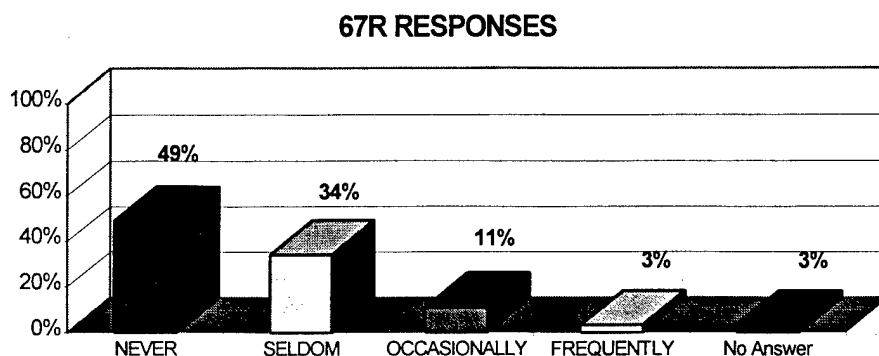
No significant comments.



**TN6. How often have you performed maintenance tasks on components while wearing:**

**MOPP IV Gear:**

**Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_**



**67R Comments**

**Problems while wearing MOPP IV and cold weather gear: (9 Comments)**

Can't see with MOPP gear. (2)

Gloves. (2)

I think the MOPP gear will get somebody hurt bad someday or maybe it already has Army-wide. (1)

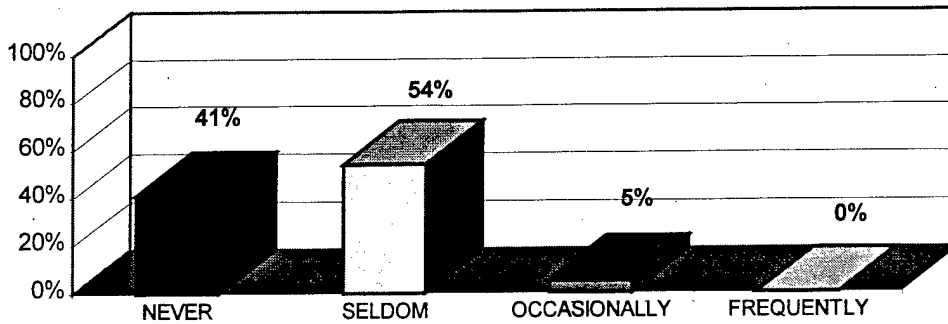
Mask. (1)

MOPP and cold weather gear are too bulky to get into small places. (1)

While inspecting main rotor strap packs, you need to remove your gloves and coat to insert your arm to borescope the strap packs. (1)

Cold weather gear is difficult due to imbalance it causes. (1)

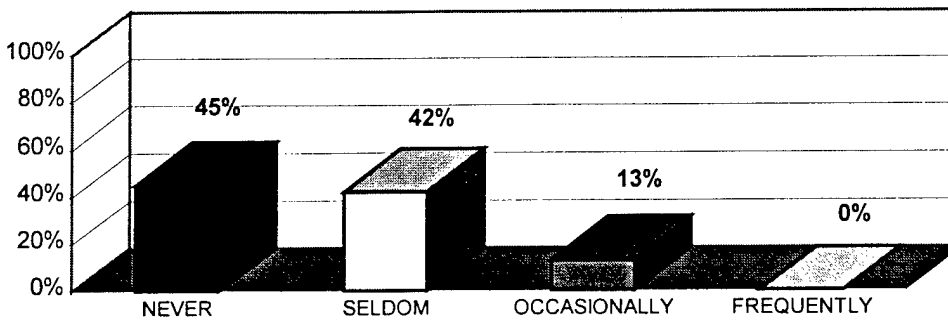
### 68X RESPONSES



### 68X Comments

No significant comments.

### 68N RESPONSES

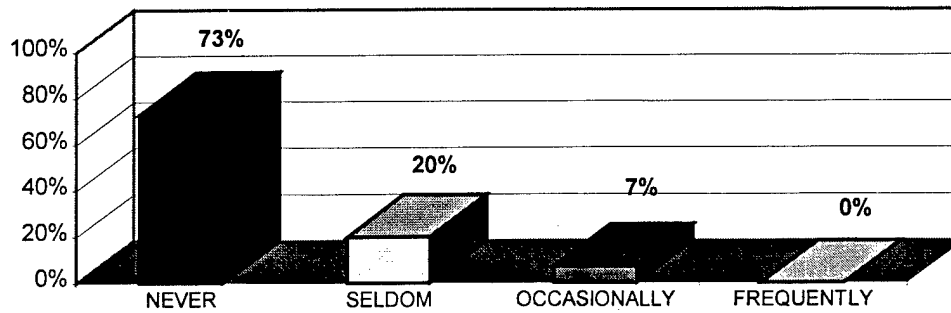


### 68N Comments

Difficulty of movement-bulky. (4 Comments)

Difficulty of movement-bulky. (4)

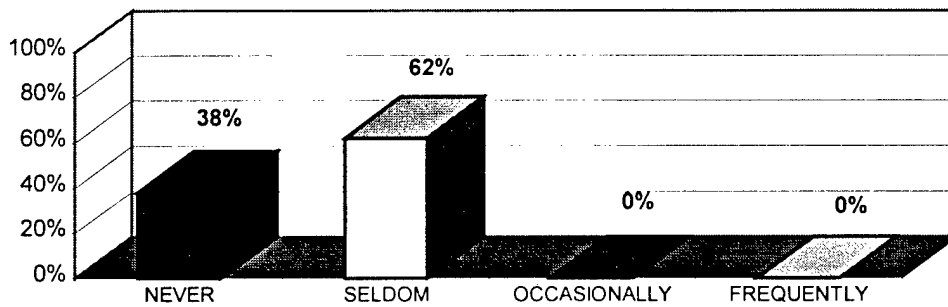
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES

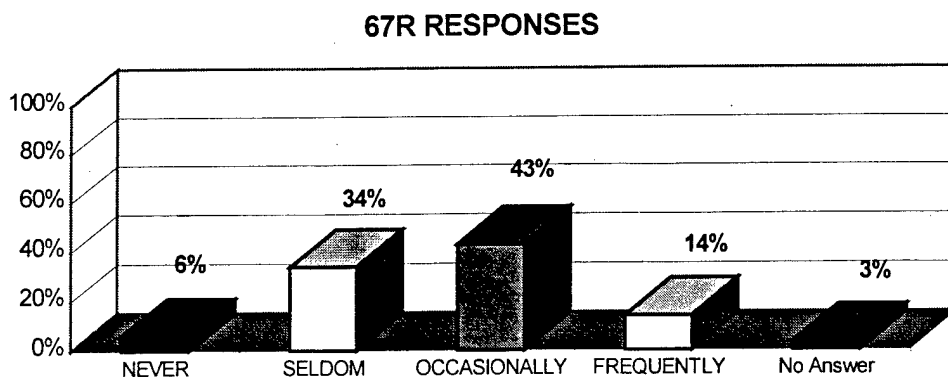


### 68D Comments

No significant comments.

### Cold Weather Gear:

Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_



### 67R Comments

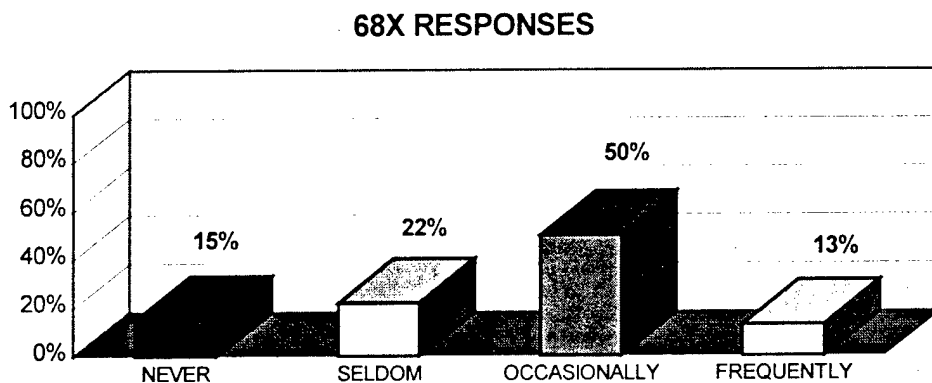
Problems while wearing cold weather gear: (5 Comments)

Gloves. (2)

MOPP and cold weather gear are too bulky to get into small places. (1)

While inspecting main rotor strap packs, you need to remove your gloves and coat to insert your arm to borescope the strap packs. (1)

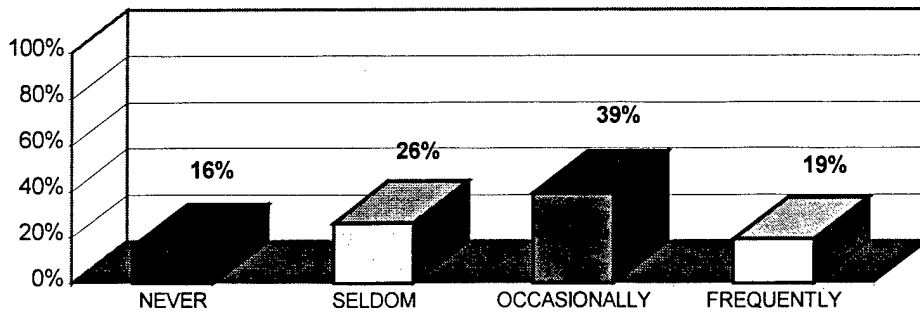
Cold weather gear is difficult due to imbalance it causes. (1)



### 68X Comments

No significant comments.

### 68N RESPONSES

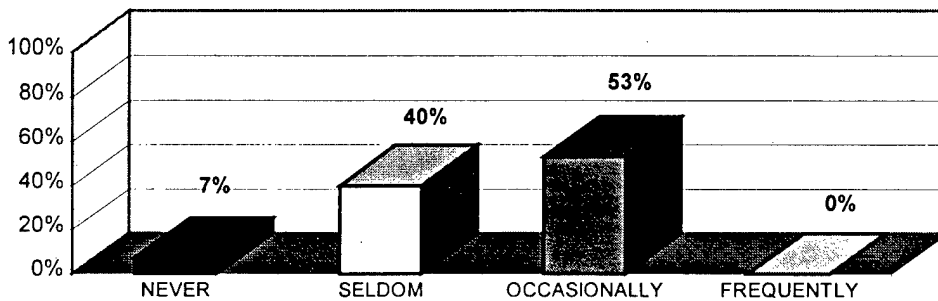


### 68N Comments

Difficulty of movement-bulky. (4 Comments)

Difficulty of movement-bulky. (4)

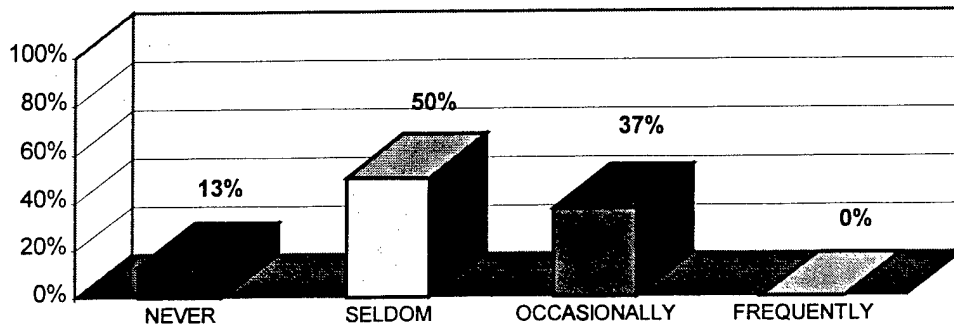
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



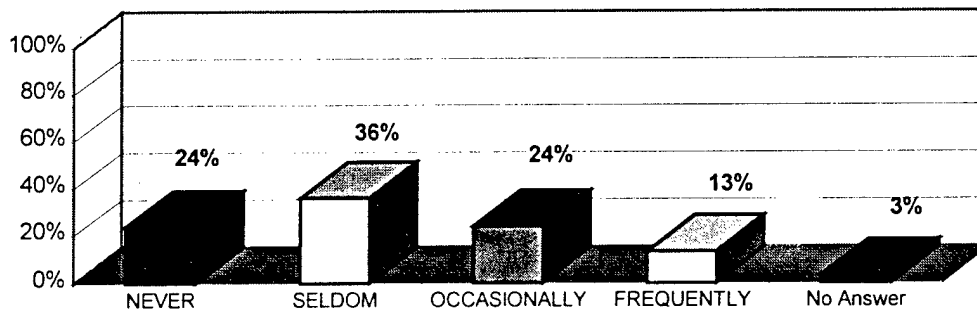
### 68D Comments

No significant comments.

### Combat Gear:

Never \_\_\_\_ Seldom \_\_\_\_ Occasionally \_\_\_\_ Frequently \_\_\_\_

### 67R RESPONSES



### 67R Comments

Problems while wearing combat gear: (10 Comments)

Weapon and load-bearing equipment hinders mobility for maintenance. (2)  
 Combat gear get hung up on wires and panels and breaks them. (2)  
 Moving around in combat gear while on the aircraft is difficult. (2)  
 During FTX's carrying the matty matel is a pain when working alone. Locking it in the crew compartment while working isn't enough according to new officers

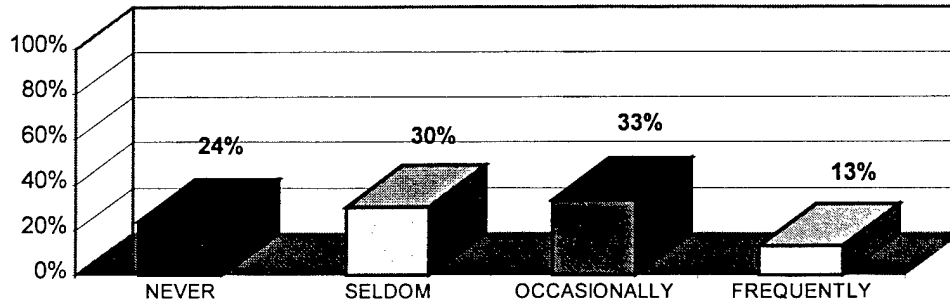
(2nd LT's, etc.). Aviation assets should have Infantry companies attached to them so that routine maintenance can be carried out.

Helmet. (1)

Carrying an M-16 up on the tail rotor. (1)

Too hard to climb up and down when wearing gear. (1)

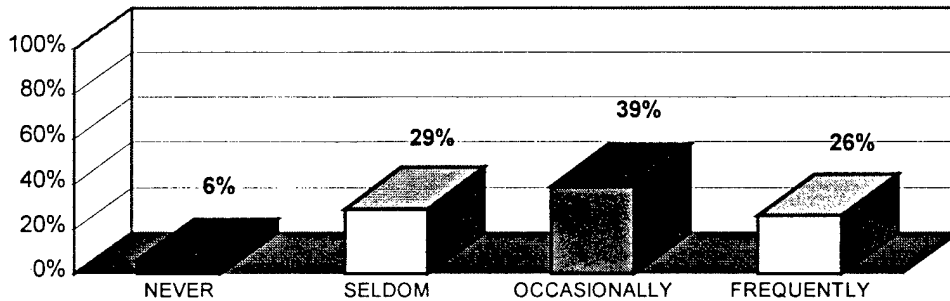
#### 68X RESPONSES



#### 68X Comments

No significant comments.

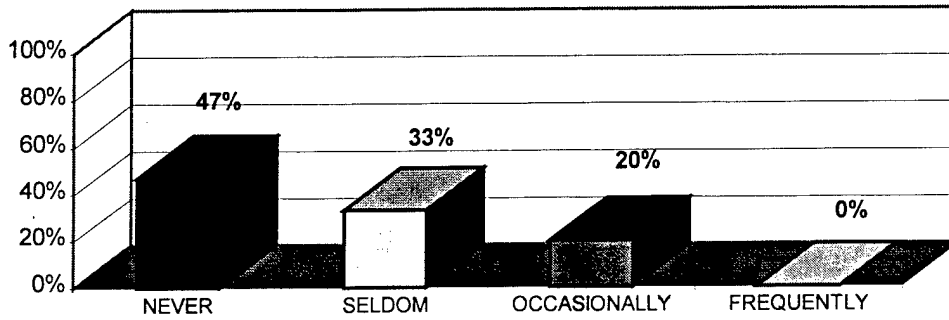
#### 68N RESPONSES



#### 68N Comments

No significant comments.

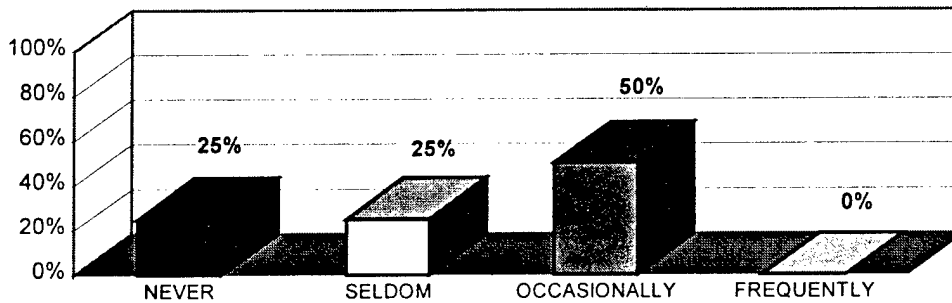
### 68B RESPONSES



### 68B Comments

No significant comments.

### 68D RESPONSES



### 68D Comments

No significant comments.

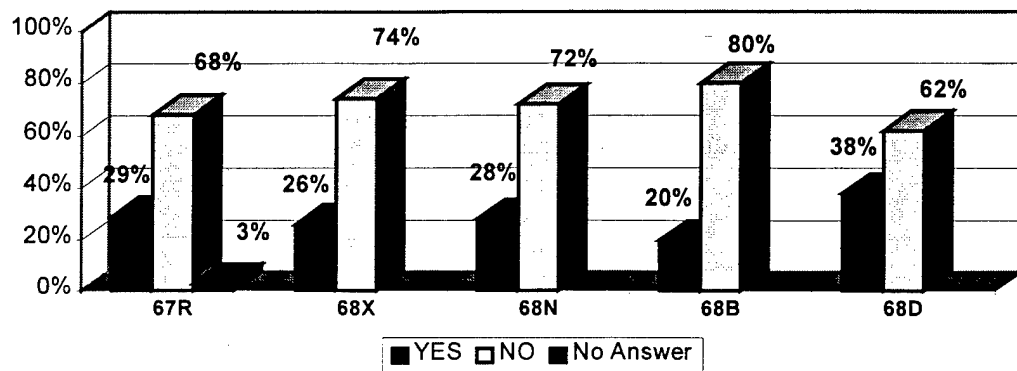


**TN7. Do you feel that the training you receive for maintaining components while wearing the following gear is sufficient?**

**MOPP IV Gear**

**Yes \_\_\_\_\_ No \_\_\_\_\_**

**MAINTAINER RESPONSES**



**If no, describe why training is not sufficient :**

#### **67R Comments**

Need more training with MOPP IV Gear: (21 Comments)

We never had to do it (MOPP IV gear). (4)

I have not had any training in these areas (all of the areas). (4)

Never do it - (MOPP, CW, CG). (3)

Not much training happened in all these areas. (2)

Never trained in MOPP gear. (2)

Not enough training. (1)

We are not doing this with gas mask affixed. Not a good idea even in non-threat situation in my opinion. Safety is compromised. (1)

Insufficient for removing switches. (1)

Insufficient for removing pressure switches. (1)

Insufficient for removing panels. (1)

Insufficient for getting into power supply system. (1)

#### **68X Comments**

Need more training with MOPP IV gear. (17 Comments)

Never to it - need more training. (10)

Not enough training. (2)  
 Hardly ever wear the stuff. (2)  
 Not enough - limited exposure (MOPP, combat gear). (1)  
 We don't do it enough because maintenance in these conditions is almost impossible - a waste of time. (1)  
 Safety. (1)

### **68N Comments**

Need more training with MOPP IV gear. (9 Comments).

No training in the above areas. (4)  
 Never train with MOPP IV gear. (2)  
 Don't do enough of it. (2)  
 Because you don't get the training until you have to do the job. (1)

### **68B Comments**

Little or no training received in MOPP IV Gear. (4 Comments).

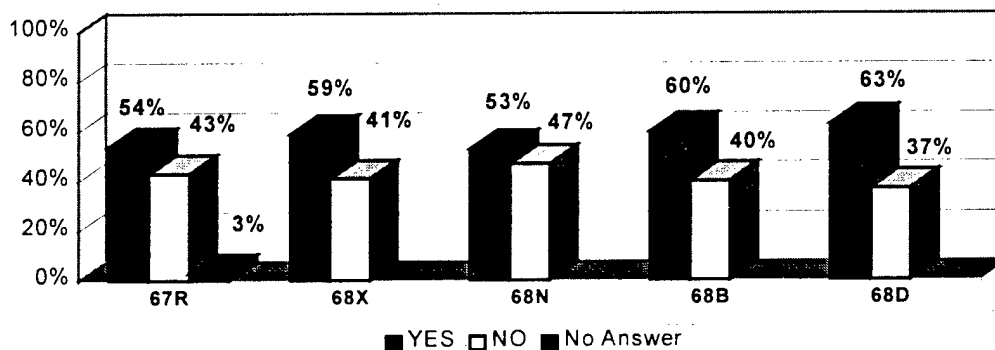
Training is not conducted. (3)  
 Not enough training. (1)

### **68D Comments**

No significant comments.

Cold Weather Gear      Yes \_\_\_\_\_      No \_\_\_\_\_

**MAINTAINER RESPONSES**



### **67R Comments**

#### **Need more training with cold weather gear: (14 Comments)**

I have not had any training in these areas. (4)  
Never do it. (3)  
Not much training happened in these areas. (2)  
Not enough training. (1)  
Insufficient for removing switches. (1)  
Insufficient for removing pressure switches. (1)  
Insufficient for removing panels. (1)  
Insufficient for getting into power supply system. (1)

### **68X Comments**

#### **Need more training with cold weather gear. (13 comments).**

Never do it - need more training. (8)  
Not enough training. (2)  
Not cold enough here to get cold weather gear. (1)  
Hardly ever wear the stuff. (1)  
We don't do it enough because maintenance in these conditions is almost impossible - a waste of time. (1)

### **68N Comments**

#### **Need more training with cold weather gear. (8 Comments).**

No training in the above areas. (4)  
Don't do enough of it. (2)  
Because you don't get the training until you have to do the job. (1)  
Never trained with cold weather gear. (1)

### **68B Comments**

#### **Little or no training received in cold weather gear. (4 Comments).**

Training is not conducted. (3)  
Not enough training. (1)

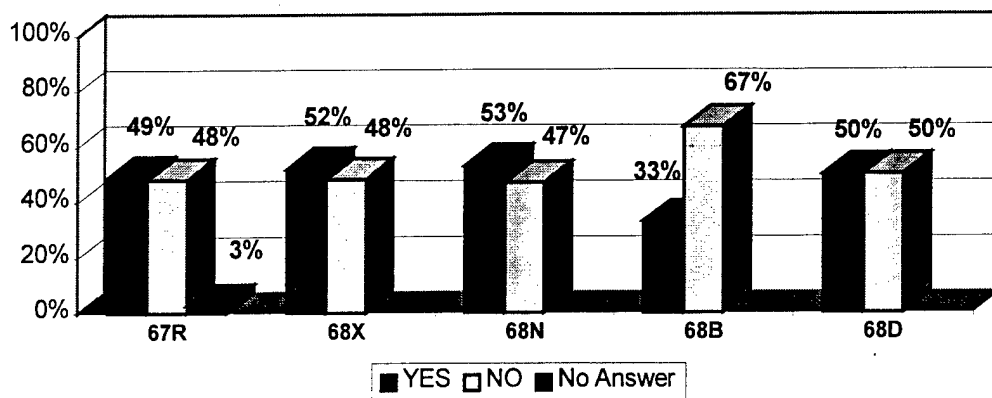
### **68D Comments**

No significant comments.

**Combat Gear**

**Yes** \_\_\_\_\_ **No** \_\_\_\_\_

### MAINTAINER RESPONSES



#### 67R Comments

##### Need more training with combat gear. (14 Comments)

I have not had any training in these areas (all of the areas). (4)

Never do it (3)

Not much training happened in these areas. (2)

Not enough training. (1)

Insufficient for removing switches. (1)

Insufficient for removing pressure switches. (1)

Insufficient for removing panels. (1)

Insufficient for getting into power supply system (all). (1)

#### 68X Comments

##### Need more training with combat gear. (12 Comments).

Never do it - need more training. (6)

Not enough training. (2)

Not enough - limited exposure (MOPP, combat gear). (1)

Hardly ever wear the stuff. (1)

We don't do it enough because maintenance in these conditions is almost impossible - a waste of time. (1)

Safety. (1)

**68N Comments**

No significant comments.

**68B Comments**

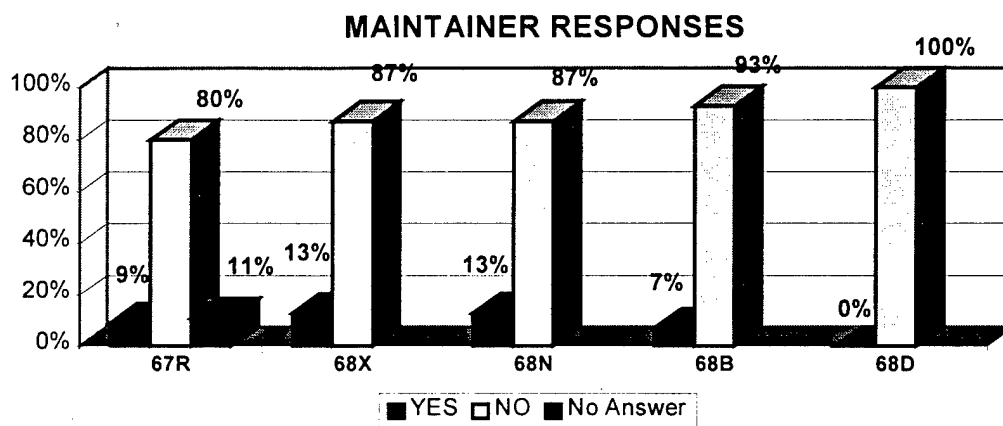
No significant comments.

**68D Comments**

No significant comments.

**TN8. Are there any areas of safety that are not adequately covered during schoolhouse or unit level training you have received?**

Yes \_\_\_\_\_ No \_\_\_\_\_



**If yes, list areas of safety and whether schoolhouse or unit level**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**TN9. List any tools or test equipment that you have not received adequate training in how to use?**

**List tools or test equipment :**

**67R Comments**

APU qualification: (7 Comments)

APU qualification. (7)

Measurement Tools: (5 Comments)

Multimeter. (3)

Micrometer. (1)

Measuring tools. (1)

Rotor System: (5 Comments)

RADDS for rotor smoothing: (5 Comments)

FDLS Training: (4 Comments)

FDLS. (4)

**68X Comments**

Pitot static test set. (4 Comments).

Pitot static test set. (4)

Diagnostic Troubleshooting Aid (DTA). (4 Comments).

DTA. (4)

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**TN10. If you have any other problems or comments related to training you have received at the schoolhouse or unit level for maintenance of components for the AH-64, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## **MAINTENANCE PROCESS**

**MP1. What are the biggest improvements that could be made to the entire maintenance process (e.g., reporting procedures, the way AVUM is organized) to reduce the time needed to maintain the AH-64 at AVUM?**

**List improvements and the time you think could be saved:**

### **67R Comments**

#### **Supply Parts: (4 Comments)**

Provide needed parts without unit parts budget constraints or time delays, i.e., repair turnarounds expedited instead of depot or vendor turn in. (1)

Giving us parts for the job so we don't get dinged on down-time. (1)

Have all assets necessary to repair aircraft and components within 1/2 mile of each other. (1)

More parts. (1)

### **68X Comments**

No significant comments.

### **68N Comments**

No significant comments.

### **68B Comments**

No significant comments.

### **68D Comments**

Transfer many or all AVIM tasks to AVUM. (3 Comments).

Lots of AVIM tasks should be AVUM - would save a lot of down time. (2)

Eliminate AVIM. (1)



**MP2 If you have any other problems or comments related to the maintenance process, please describe them here:**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

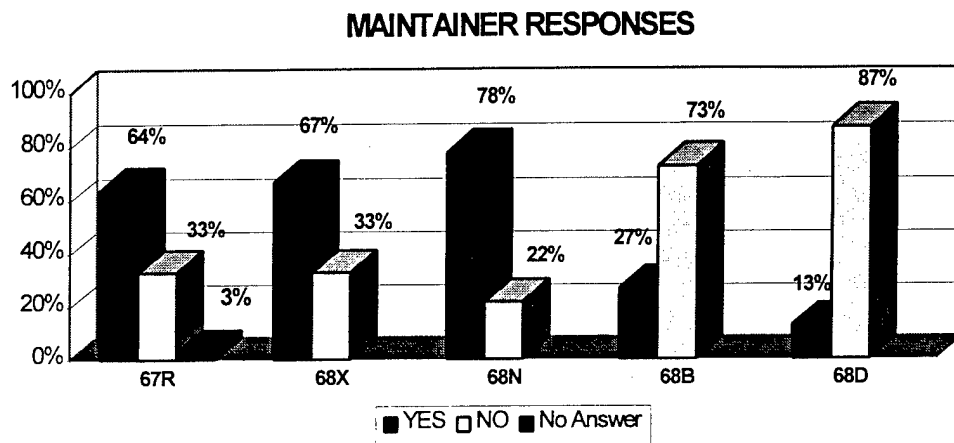
**68D Comments**

No significant comments.

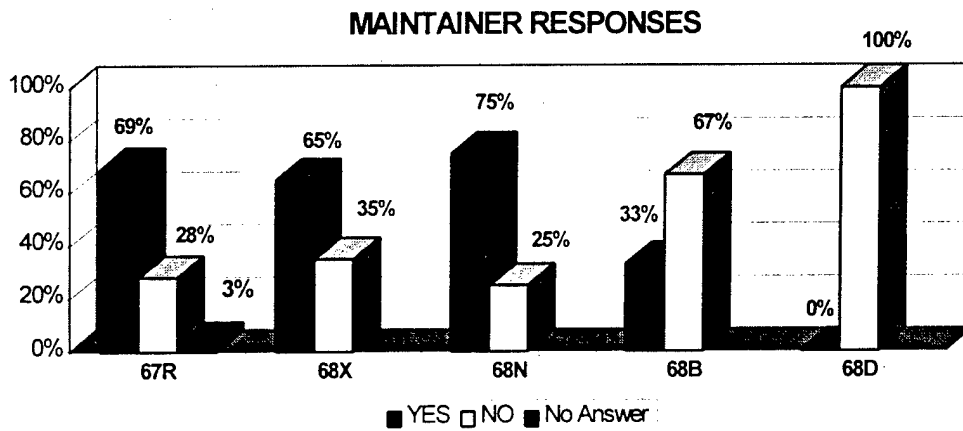
## SAFETY PROBLEMS

SA1. Have you experienced any of the following safety problems while performing the tasks listed below?

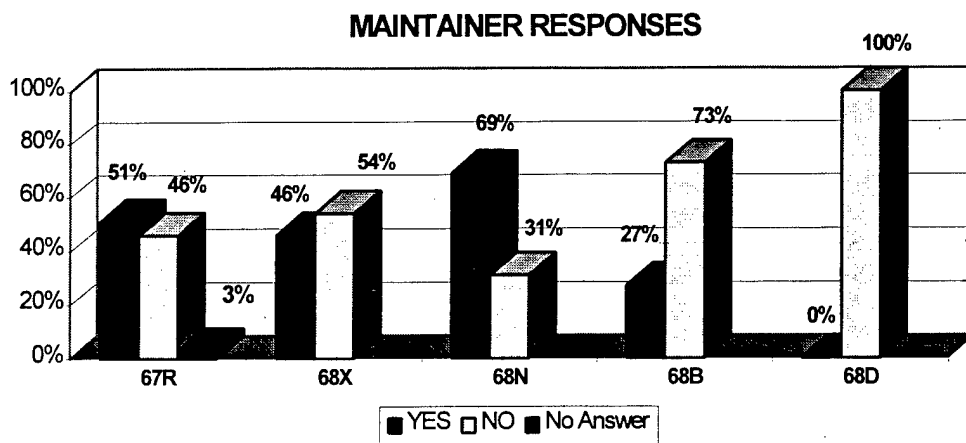
### Hot Surfaces While Troubleshooting Aircraft Components:



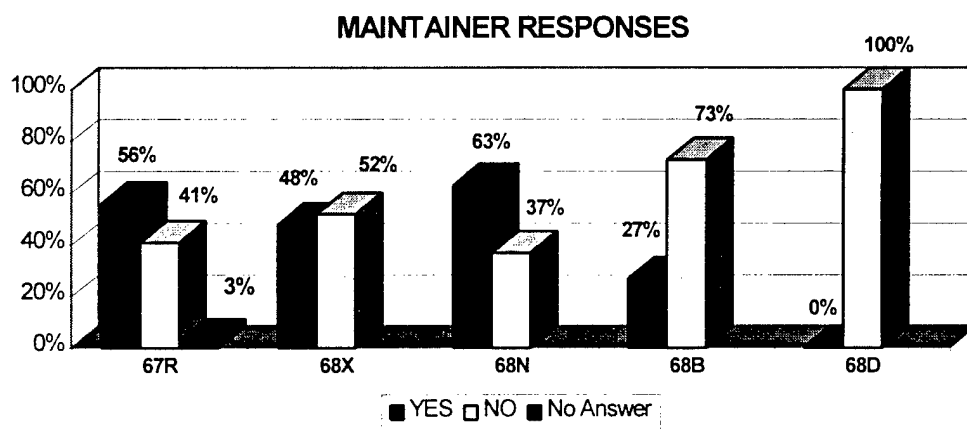
### Hot Surfaces While Accessing Aircraft Components:



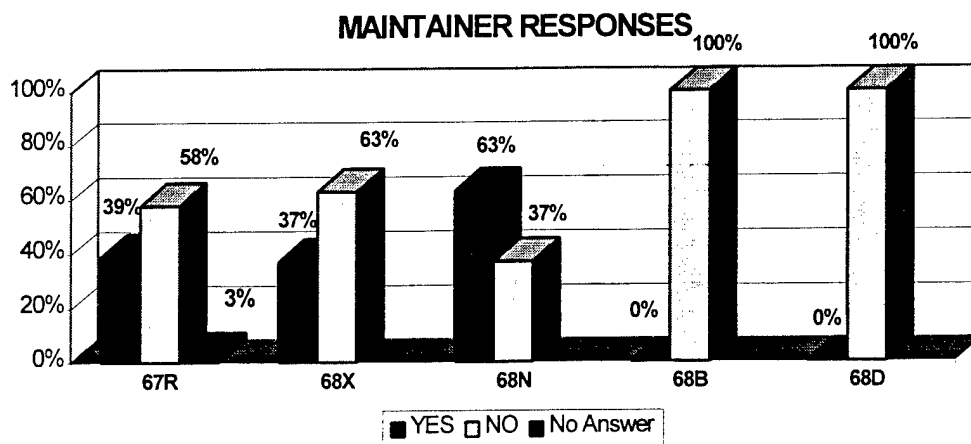
### Hot Surfaces While Fastening and Unfastening Component Fasteners:



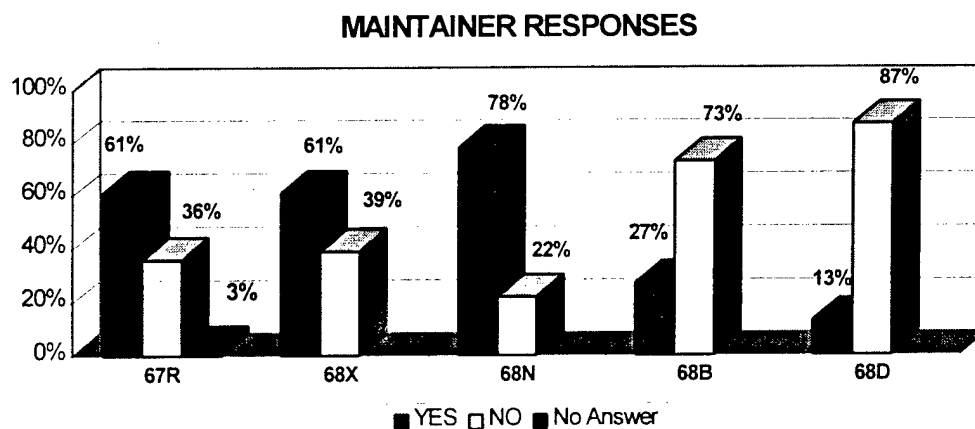
### Hot Surfaces While Connecting and Disconnecting Aircraft Components:



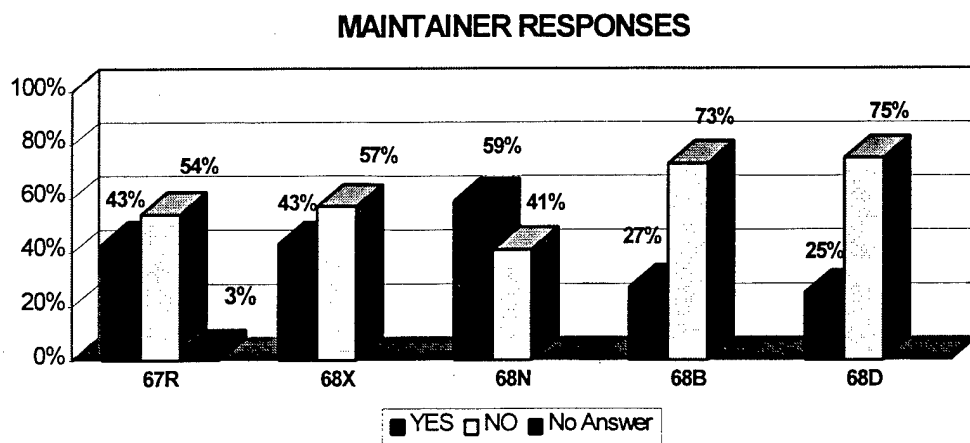
### Hot Surfaces While Lifting and Carrying Aircraft Components:



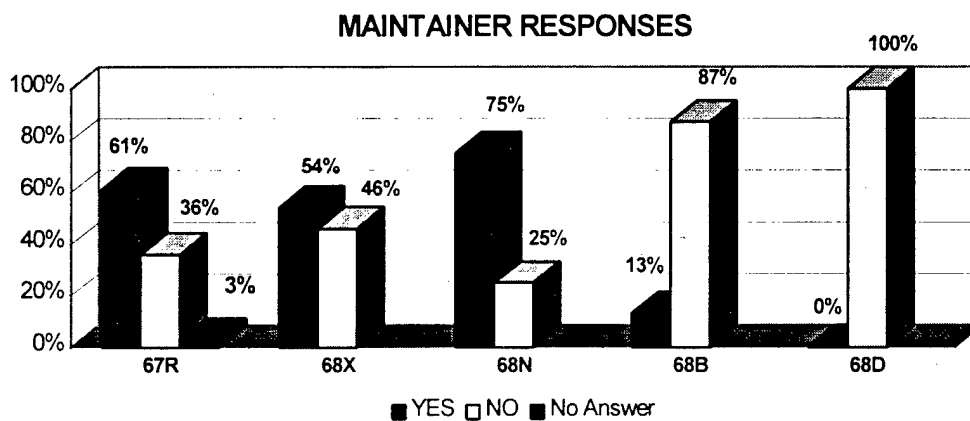
### Hot Surfaces While Removing and Replacing Aircraft Components:



### Hot Surfaces While Performing Operational Checks On Aircraft Components:



### Hot Surfaces While Inspecting Aircraft Components:



**Please describe safety problems you have encountered with Hot Surfaces:**

**67R Comments**

Hot Surfaces: (13 Comments).

Surfaces are "hot" a majority of the time - aircraft surface and components temperature reach high enough to burn and blister. (4)

Hot surfaces usually due to sun. (3)

Working in Arizona - all surfaces are hot. (2)

Hoses can be hot when disconnecting. (1)

Hot surfaces. (1)

There are a lot of hot surfaces in the catwalk area while the APU is running. (1)

Have been burned while taking oil sample from APU because you have to get oil sample while APU is still hot. (1)

**68X Comments**

Hot surfaces. (10 Comments)

Hot surfaces due to sun. (3)

Hot surfaces when performing tasks during the summer. (2)

Hot surfaces when working in transmission bay. (2)

It's hot, O.K.!? It's sharp, O.K.? Stick you hand up there and find out! You don't pay me enough \$ to do this anymore!! (1)

Pitot-static tubes under acft near turret are hot. (1)

Hot surfaces after operational checks. (1)

**68N Comments**

Hot Surfaces. (15 Comments).

Aircraft has a lot of hot surfaces. (4)

In the summer months, all black boxes are hot. (4)

Heat from the environment is a big problem here. Especially after black paint soaks it up. (3)

Heat is a problem for all aircraft when you get into tight areas. (1)

Safety switch on tailboom for chaff-flare is a hot spot when working in platform area of aircraft. (1)

APR-39 get very hot. (1)

Aircraft surfaces get hot when aircraft spends prolonged time in the heat. (1)

### **68B Comments**

Hot surfaces. (3 Comments)

Aircraft run up after shutdown. (2)

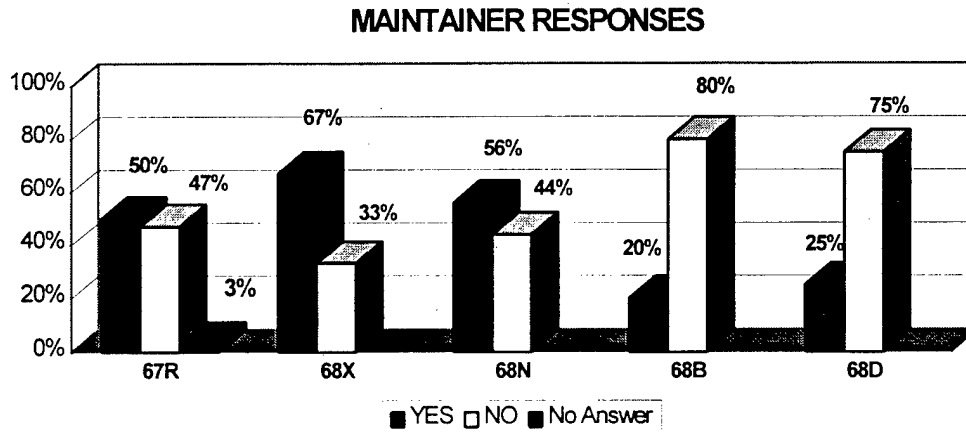
Hot engines after run up. (1)

### **68D Responses**

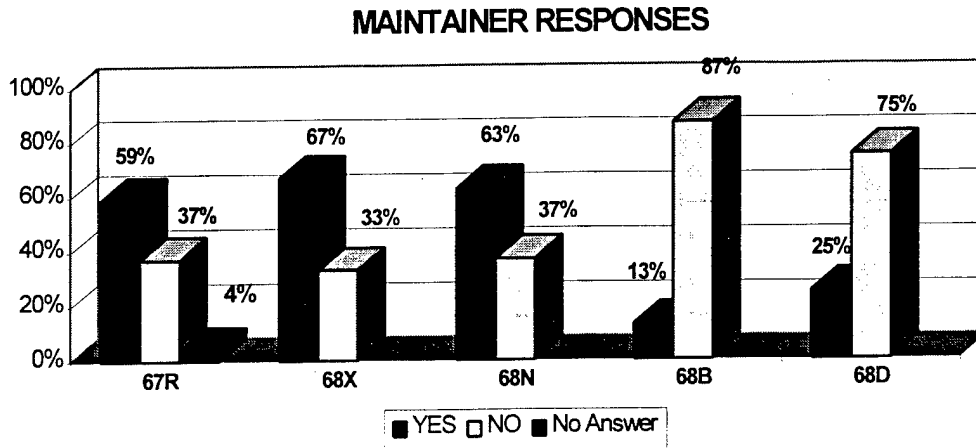
Hot surfaces. (1 Comment)

NGB seal gets hot. (1)

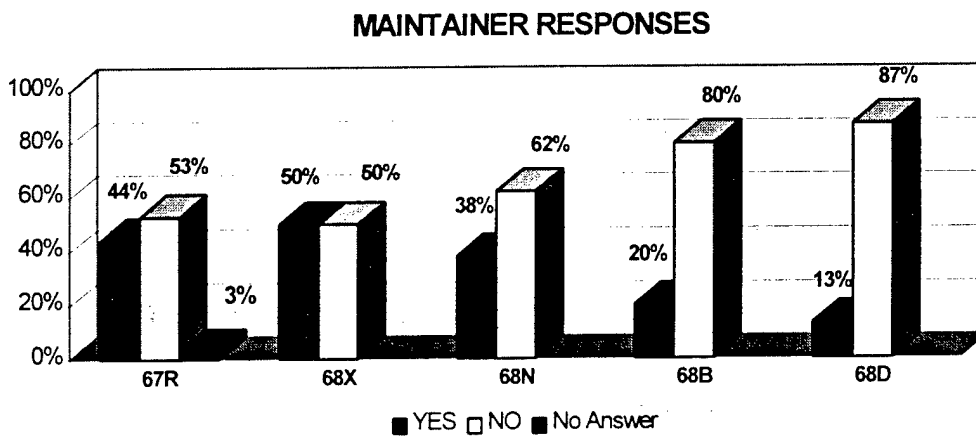
### **Sharp Surfaces While Troubleshooting Aircraft Components:**



**Sharp Surfaces While Accessing Aircraft Components:**

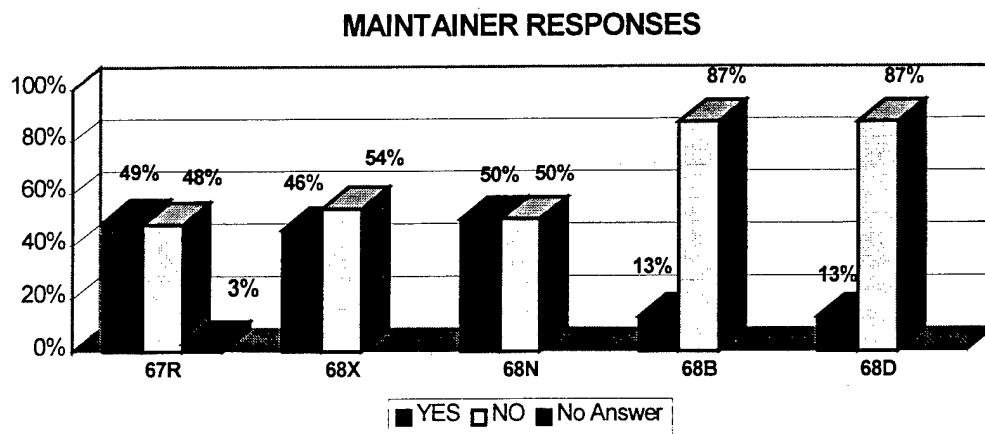


**Sharp Surfaces While Fastening and Unfastening Component Fasteners:**

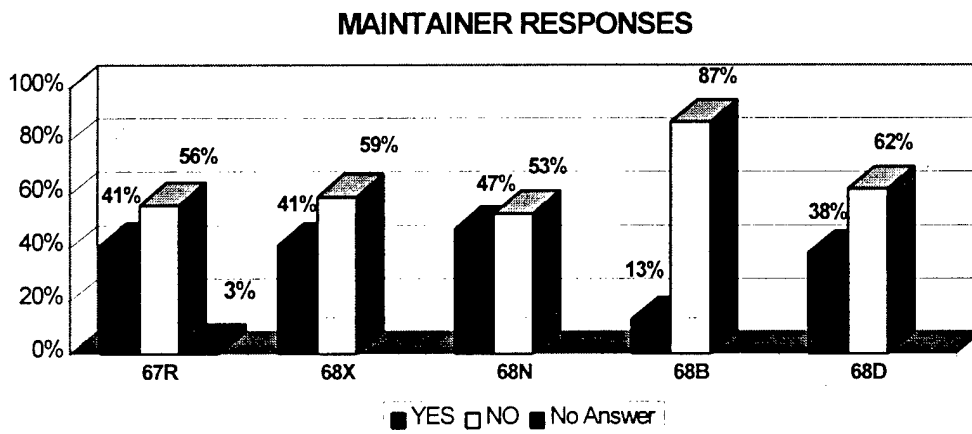




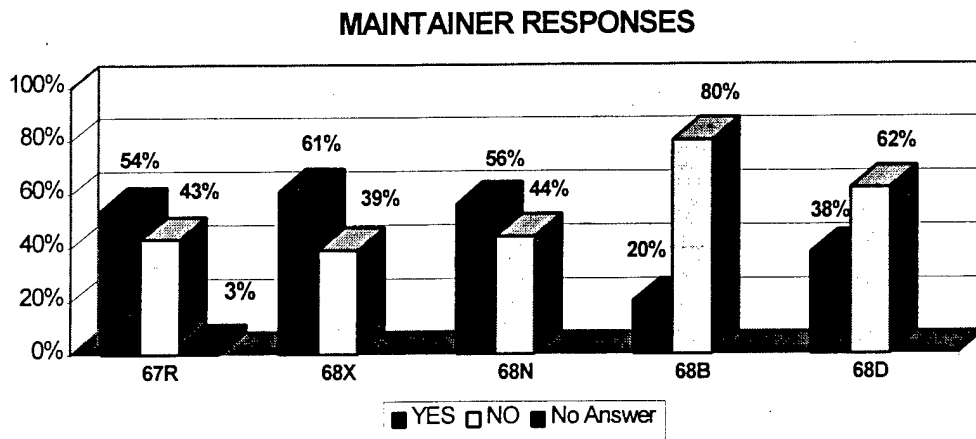
**Sharp Surfaces While Connecting and Disconnecting Component Connectors:**



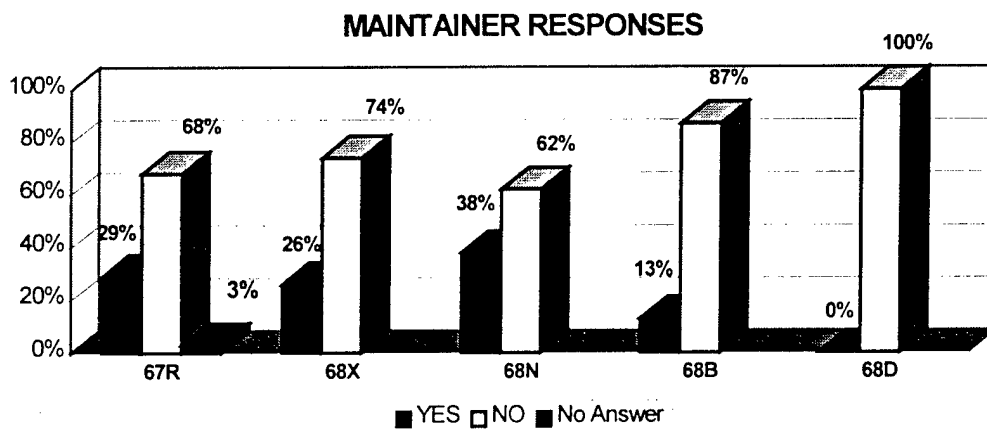
**Sharp Surfaces While Lifting and Carrying Aircraft Components:**



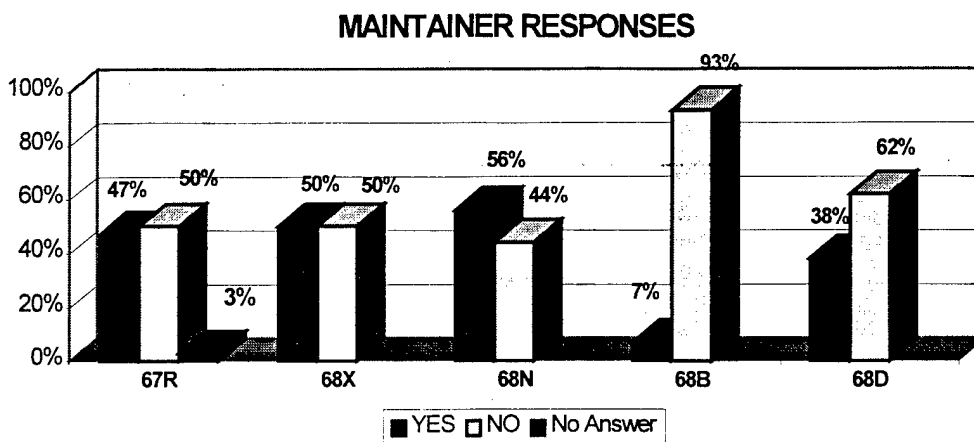
**Sharp Surfaces While Removing and Replacing Aircraft Components:**



**Sharp Surfaces While Performing Operational Checks On Aircraft Components:**



## Sharp Surfaces While Inspecting Aircraft Components:



### 67R Responses

#### Sharp Surfaces: (5 Comments)

Most areas of the aircraft have sharp surfaces. A day does not go by that I don't cut myself no matter how careful I am. (1)

Sharp surfaces throughout aircraft. (1)

I can always find something sharp to cut myself (e.g., cotter pins, clamp). (1)

Safety wire. (1)

Cotter pins. (1)

### 68X Comments

#### Sharp Surfaces. (6 Comments)

Sharp surfaces due to screws that stick out on the back of cannon plugs.(3)

It's hot O.K.!? It's sharp, O.K.!? Stick your hand up there and find out! You don't pay me enough \$ to do this anymore!! (1)

Sharp surfaces due to insufficient work space. (1)

Safety wire is sharp. (1)

### 68N Comments

No significant comments.

### 68B Comments

Sharp surfaces. (1 Comment).

Many sharp or frayed items on engines. (1)

### 68D Comments

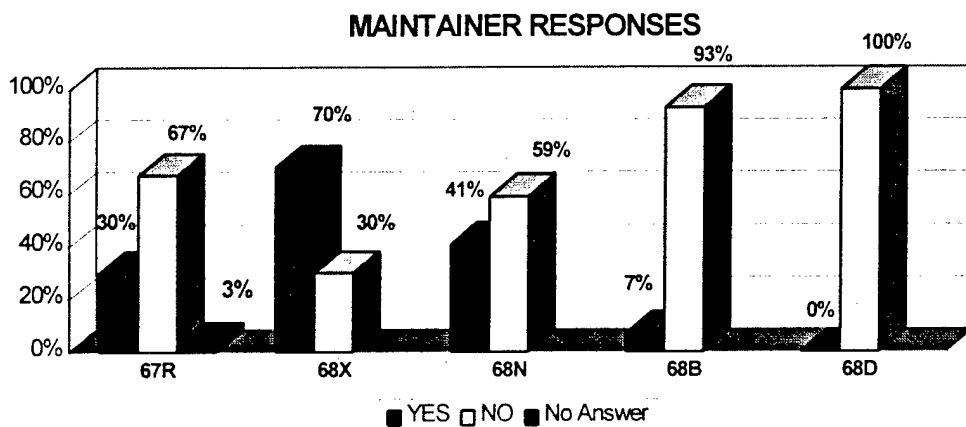
Sharp surfaces. (3 Comments).

Stainless steel shims on stabilator are sharp. (1)

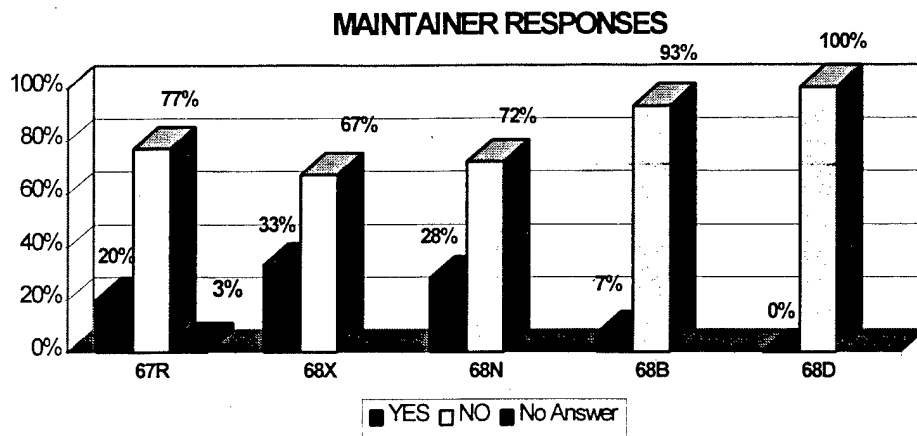
Sharp surfaces in the catwalk area. (1)

Sharp surfaces on strap pack - main rotor head. (1)

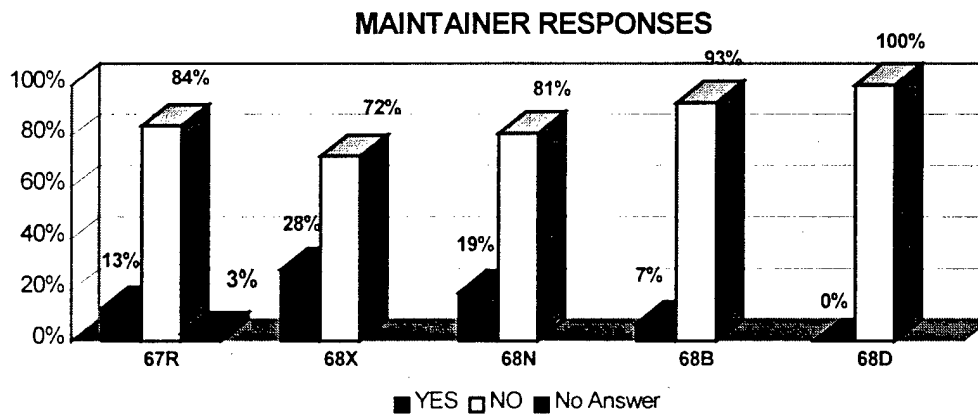
### Electrical Hazards While Troubleshooting Aircraft Components:



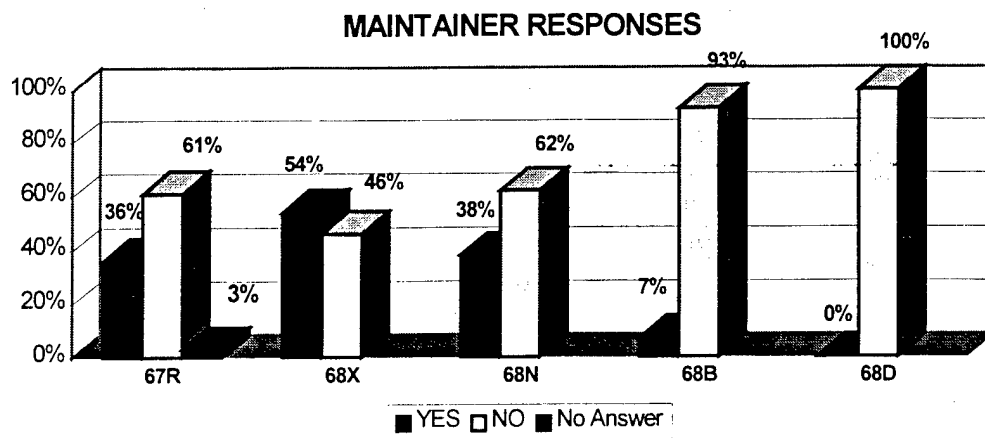
**Electrical Hazards While Accessing Aircraft Components:**



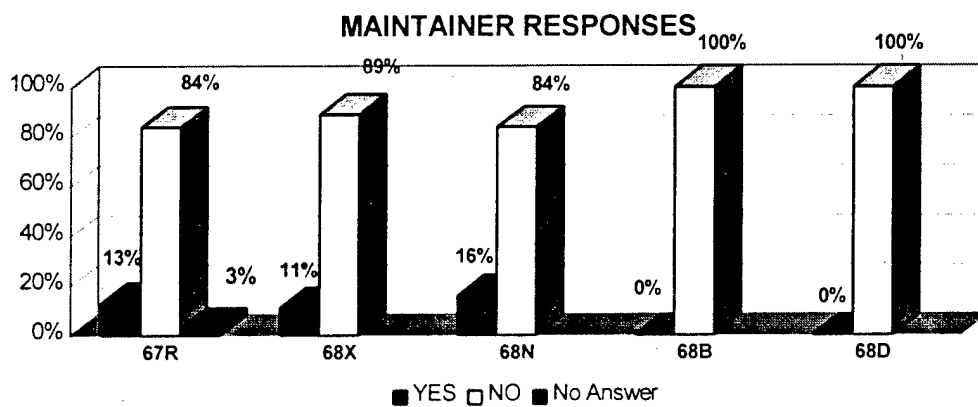
**Electrical Hazards While Fastening and Unfastening Component Fasteners:**



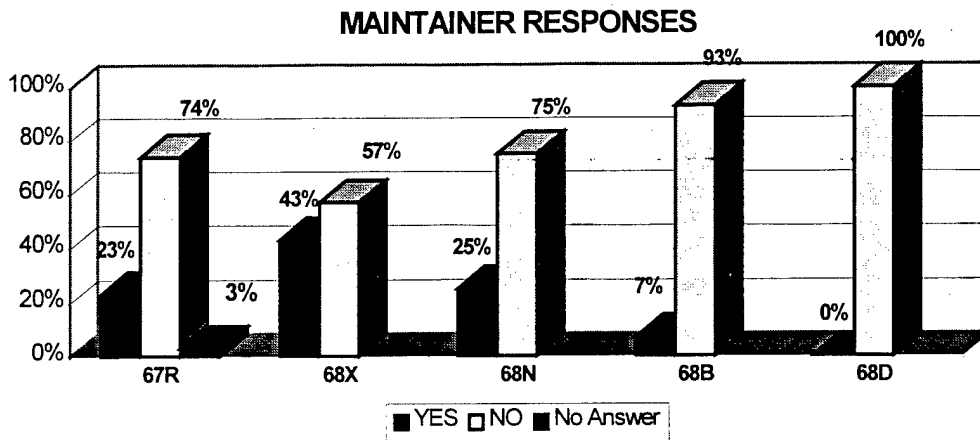
**Electrical Hazards While Connecting and Disconnecting Component Connectors:**



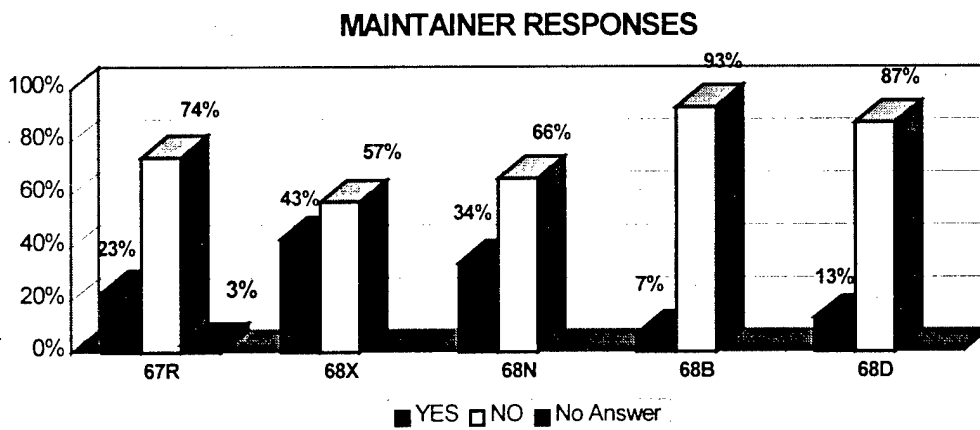
**Electrical Hazards While Lifting and Carrying Aircraft Components:**



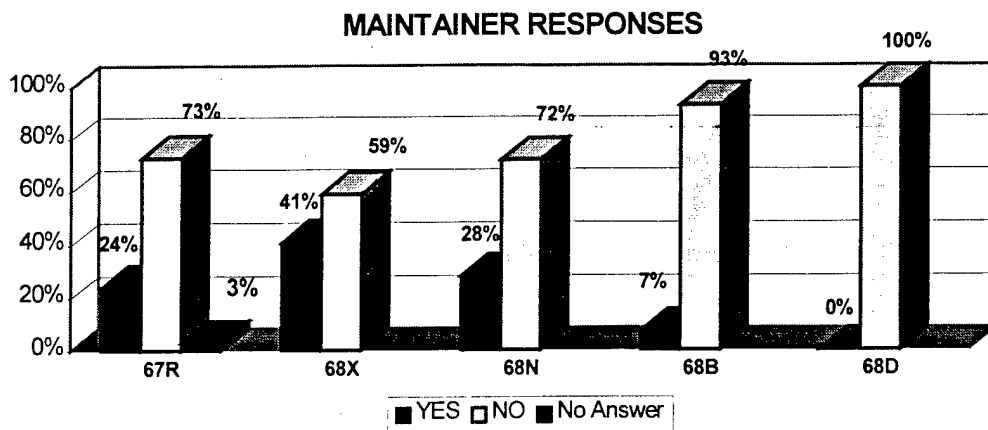
**Electrical Hazards While Removing and Replacing Aircraft Components:**



**Electrical Hazards While Performing Operational Checks On Aircraft Components:**



## Electrical Hazards While Inspecting Aircraft Components:



### 67R Responses

No significant comments.

### 68X Responses

Electrical Hazards. (4 Comments).

Electrical hazards during power-on electrical troubleshooting. (3)

Electrical hazards while doing voltage checks on AIA - hard to reach cannon plugs.

(1)

### 68N Responses

Electrical Hazards. (4 Comments.).

Electrical hazards due to old wiring. (3)

Anytime electrical power is applied to aircraft. (1)

### 68B Responses

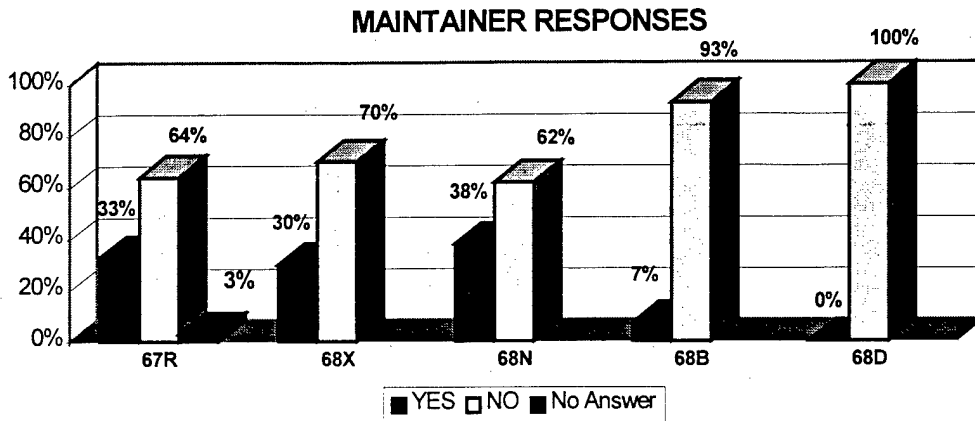
No significant comments.



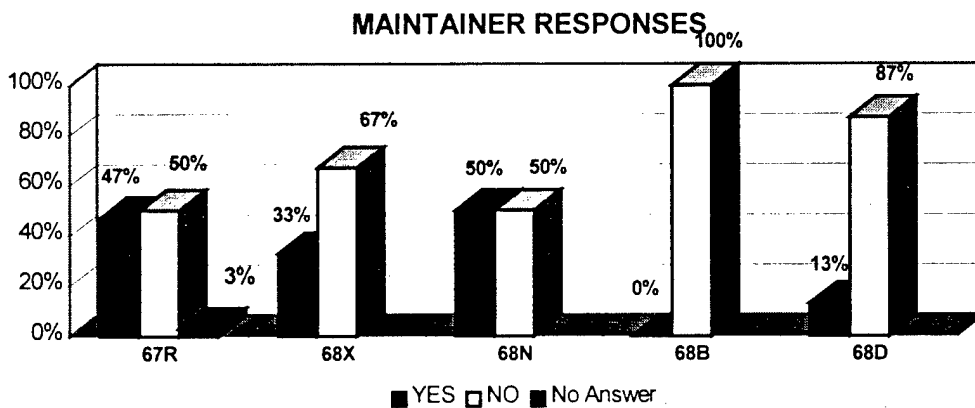
### 68D Responses

No significant comments.

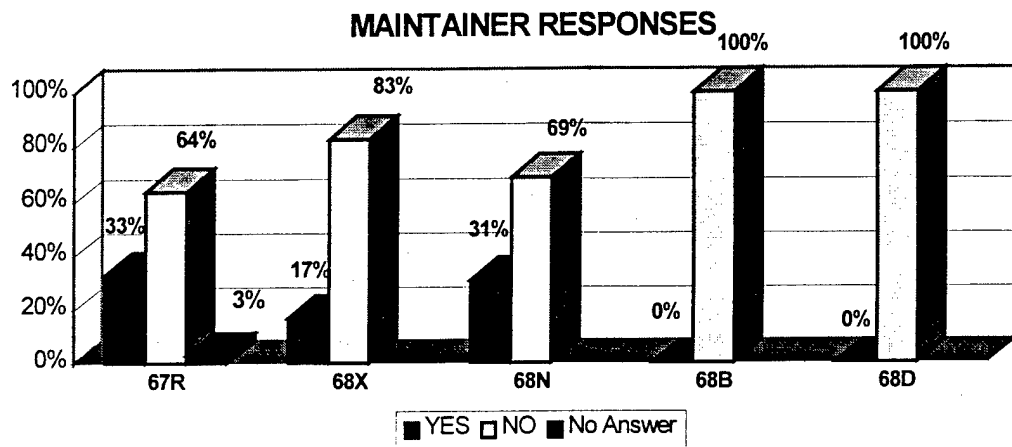
### Falling Off Of The Aircraft While Troubleshooting Aircraft Components



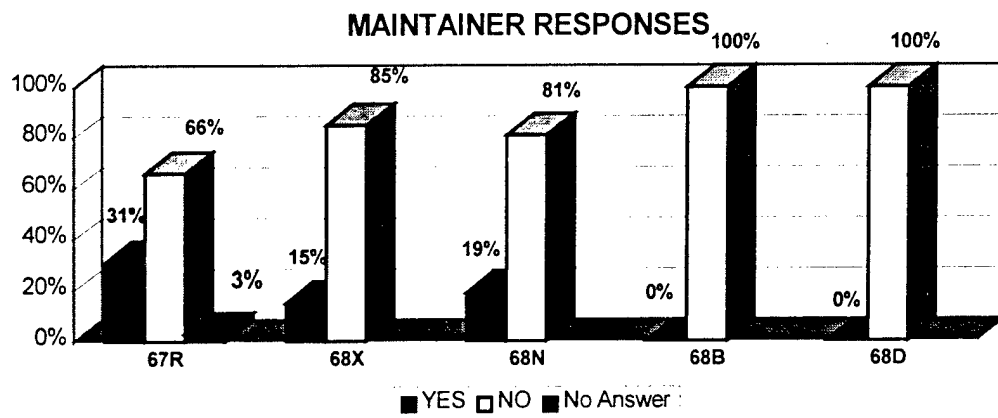
### Falling Off Of The Aircraft While Accessing Aircraft Components



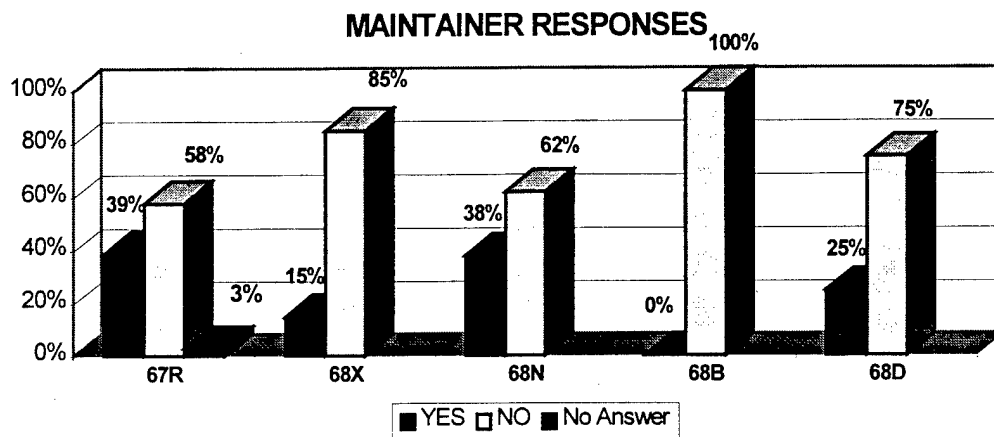
### Falling Off Of The Aircraft While Fastening and Unfastening Component Fasteners



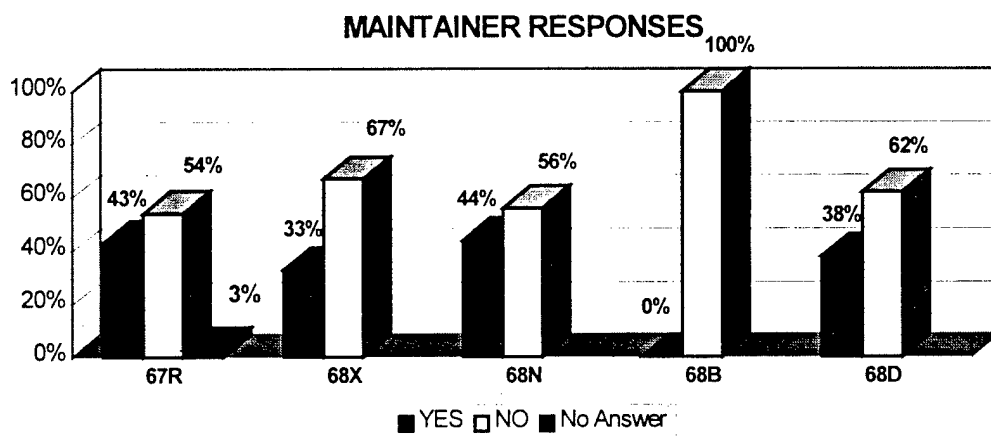
### Falling Off Of The Aircraft While Connecting and Disconnecting Component Connectors



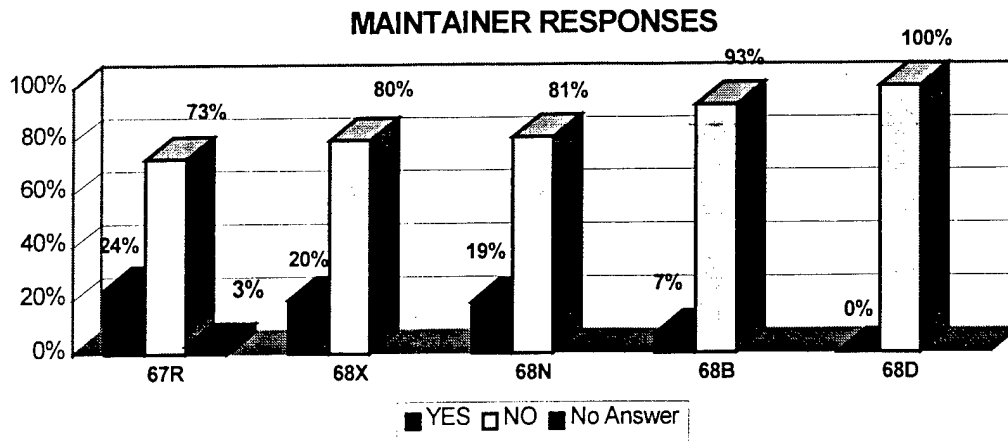
## Falling Off Of The Aircraft While Lifting and Carrying Aircraft Components



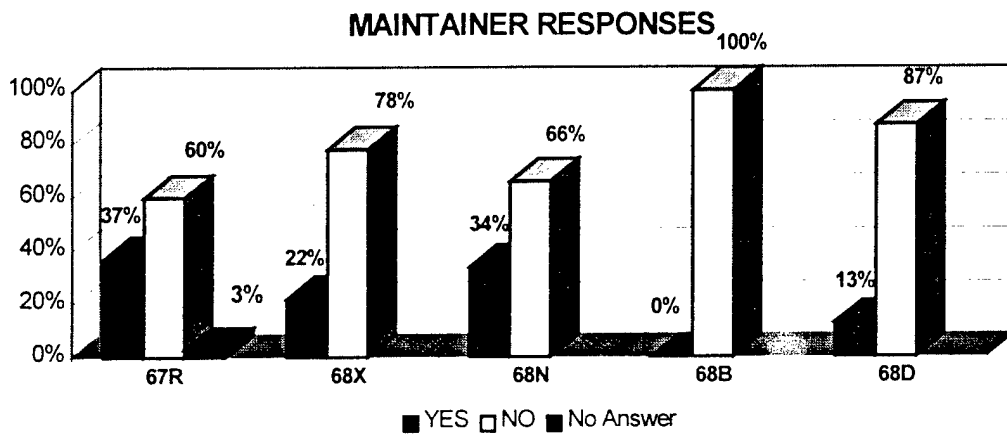
## Falling Off Of The Aircraft While Removing and Replacing Aircraft Components



## Falling Off Of The Aircraft While Performing Operational Checks On Components



## Falling Off Of The Aircraft While Inspecting Aircraft Components



### **67R Comments**

#### **Falling off of Aircraft: (11 Comments)**

Have fallen off the aircraft while trying to access and unfasten-fasten L-540 panel. (6)

Falling is most of the time a problem especially on the flightline. (1)

Winds. (1)

Changing tail light bulb can cause you to fall off of aircraft. (1)

Removal of main rotor drive plate. (1)

Acft position light (need workstand). (1)

### **68X Comments**

No significant comments.

### **68N Comments**

#### **Falling off of aircraft. (11 Comments)**

Getting on and off aircraft can cause you to fall. (3)

Falling off aircraft while on top by tail rotor while troubleshooting APR-39 receiver. (2)

Catwalk by ALQ-144 is easy to fall off of. (2)

Getting in and out of the cockpits can cause you to fall off the aircraft. (1)

Aircraft surface is not safe to stand on as it has no traction. (1)

Have lost balance while reaching across the aircraft. (1)

Fell off the tailboom without the right stand for maintenance.(1)

### **68B Comments**

No significant comments.

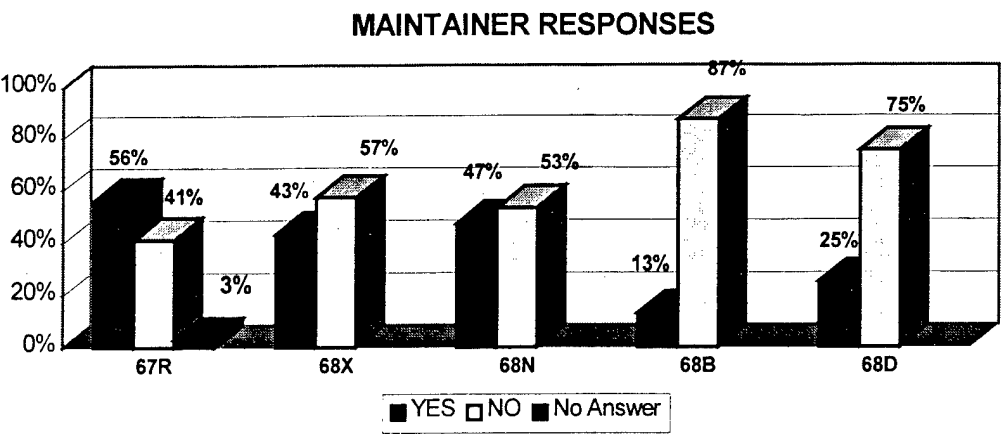
### **68D Comments**

#### **Falling off of aircraft. (2 Comments)**

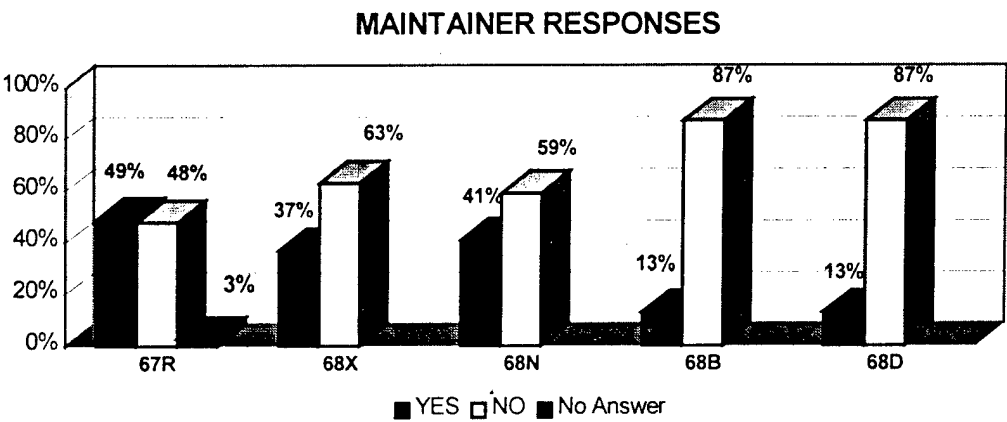
May fall off when removing main rotor head components. (1)

Can fall off of aircraft when screwing on the main rotor head bolt nuts because it takes a 5 foot cheater bar and 3 people to do the job. (1)

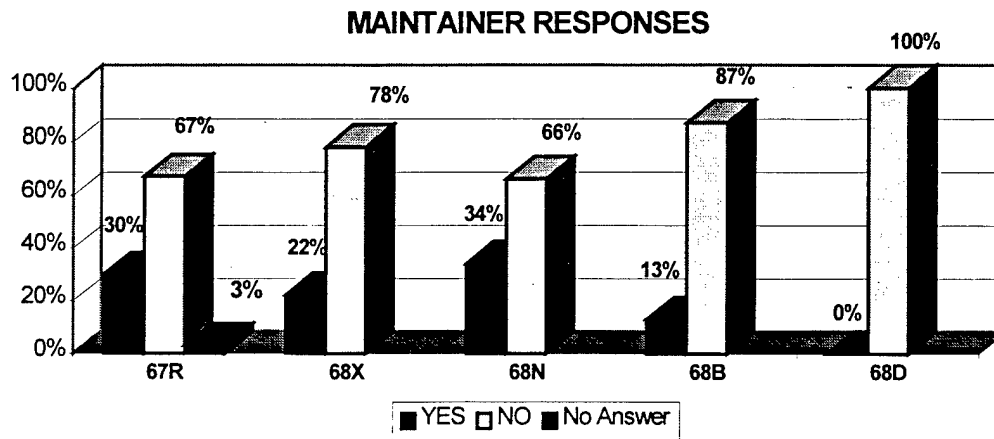
**Fluid Spills While Troubleshooting Aircraft Components**



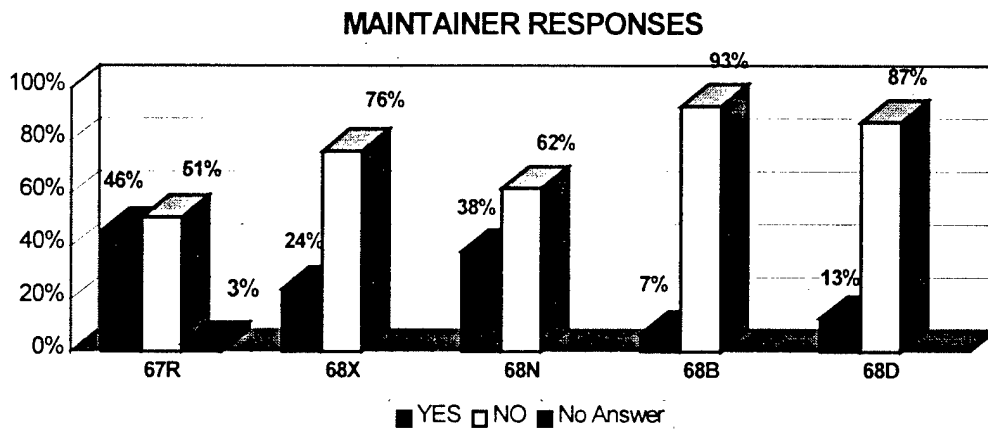
**Fluid Spills While Accessing Aircraft Components**



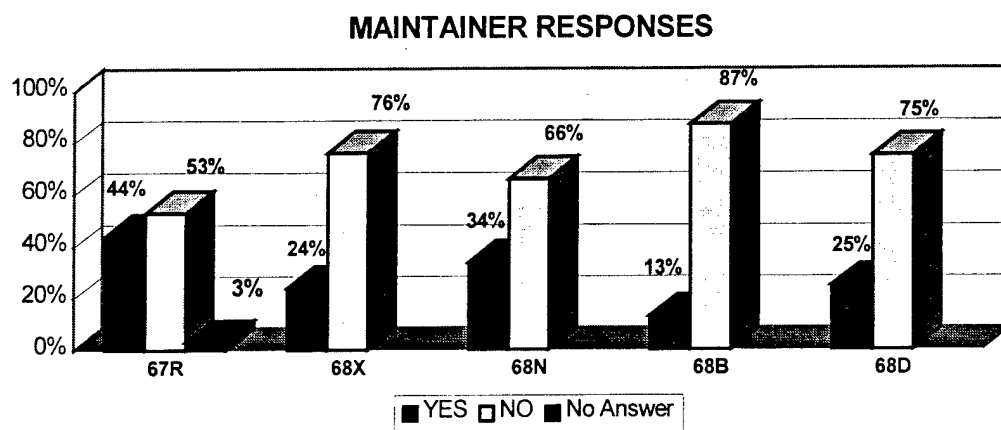
## Fluid Spills While Fastening and Unfastening Aircraft Component Connectors



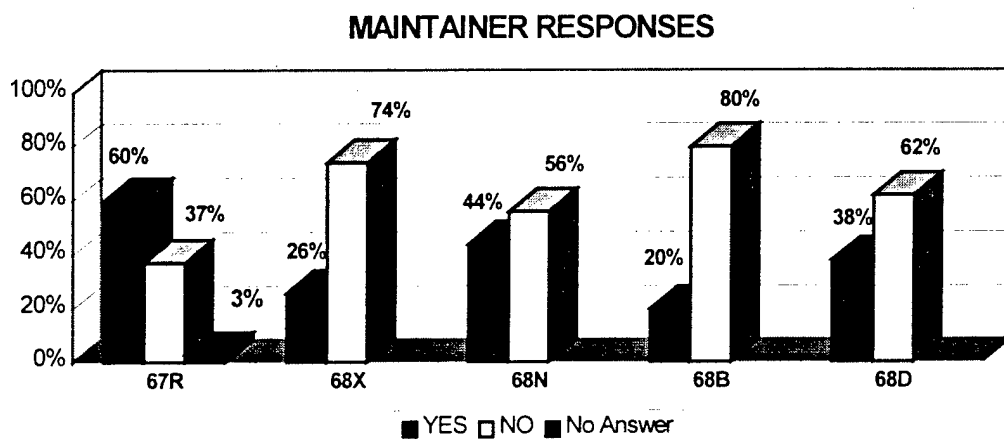
## Fluid Spills While Connecting and Disconnecting Component Connectors



## Fluid Spills While Lifting and Carrying Aircraft Components

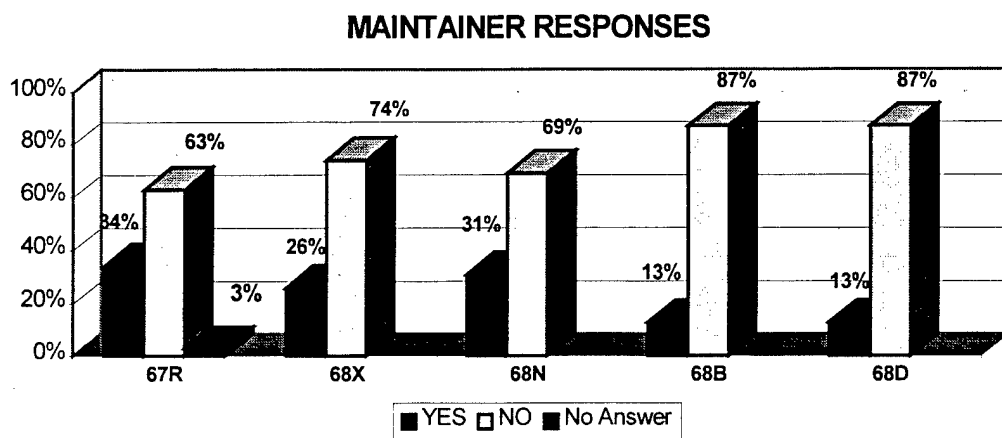


## Fluid Spills While Removing and Replacing Aircraft Components

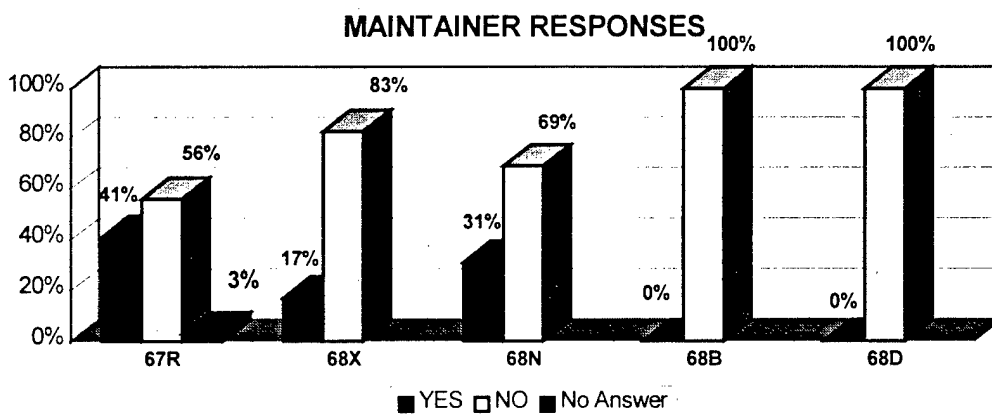




## Fluid Spills While Performing Operational Checks On Aircraft Components



## Fluid Spills While Inspecting Aircraft Components



## **67R Comments**

### Fluid spills:(14 comments)

Fuel spills from engine fuel lines. (2)

Hydraulic fluid spills from APU. (2)

The aircraft leaks a lot of fluid making it a place to be cautious of fluid spills. (1)

Handholds become contaminated with oil or hydraulic fluids making them slippery. (1)

Changing some transducers - oil will escape. (1)

Hydraulic fluid spills. (1)

Removing a dirty filter indicator resulted in a hydraulic spill. (1)

Components should be fully drained of fluid before removing them.(1)

Provide caps for lines that we remove. (1)

Disconnecting GSE lines. (1)

When disconnecting hydraulic service hoses, if you don't turn down the pressure from the AGPU, you can get a hydraulic spill. (1)

Main problem is fluid spills while taking oil samples from APU. (1)

## **68X Comments**

### Fluid Spills. (6 Comments)

Hydraulic leaks. (3)

Hydraulic fluid on transmission panels. (2)

Hydraulic leaks from the gun turret and pylons. It causes floors to get slick until its cleaned up. I've seen people slip on it. (1)

## **68N Comments**

### Fluid spills. (11 Comments).

Doppler antenna collects hydraulic fluid. (3)

Fluid on antenna's. (3)

Radar altimeter gets fluid spilled on it. (2)

Loop antenna gets fluid spilled on it. (1)

There is always fluid spilling from the aircraft. (1)

I turned on the power and the crewchief had the fuel cell open and so the fuel sprayed everywhere. (1)

### **68B Comments**

Fluid spills. (1 Comment).

Fuel and oil lines on engines. (1)

### **68D Comments**

Fluid spills. (2 Comments).

Blown seals coat aircraft with fluid. (1)

Grease and oil spill from tail rotor input seal. (1)

### **Other Safety Problem**

Laser Protection (1 Comment)

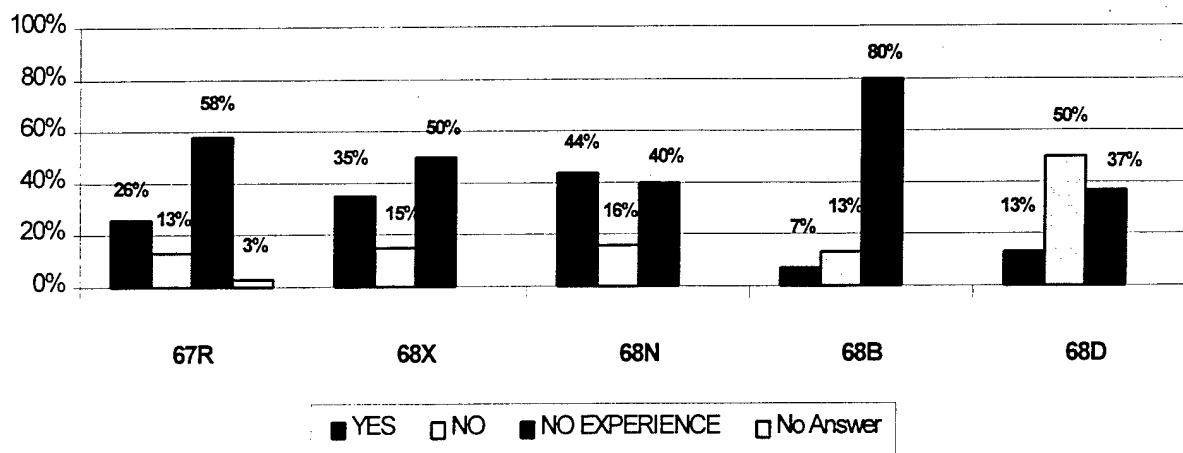
Since Desert Storm, I have wondered why laser safety goggles are given to pilots only. If deployed forward as in a FARP, as a 68X, I am just as much at risk to inadvertent exposure to Class IV laser light. This is mentioned because internal boresight of optics was often done during rearm and refuel operations.

## AFFECTS OF CLOTHING

**AOC1. Have you had any problems performing the following tasks while wearing the gear listed below?**

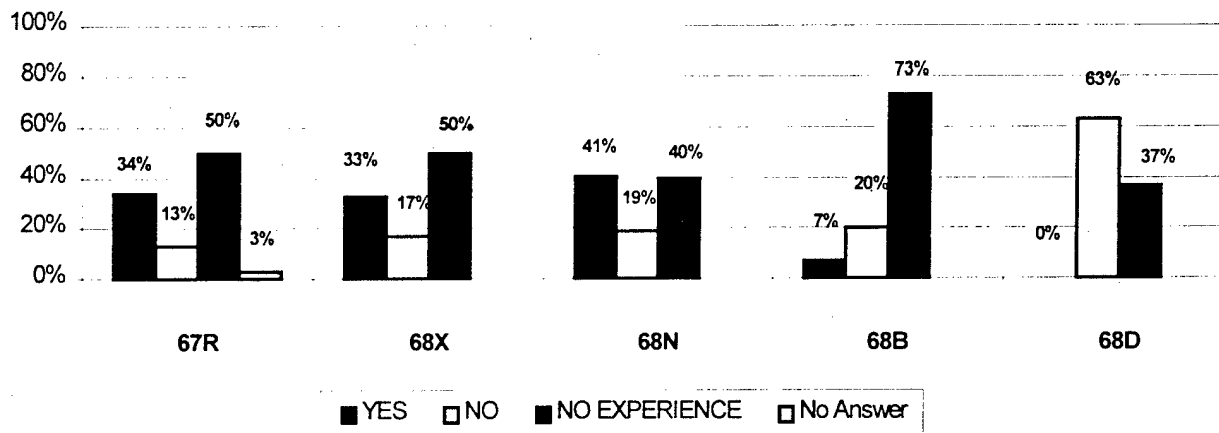
### Problems With MOPP IV Gear While Troubleshooting Aircraft Components

#### MAINTAINER RESPONSES



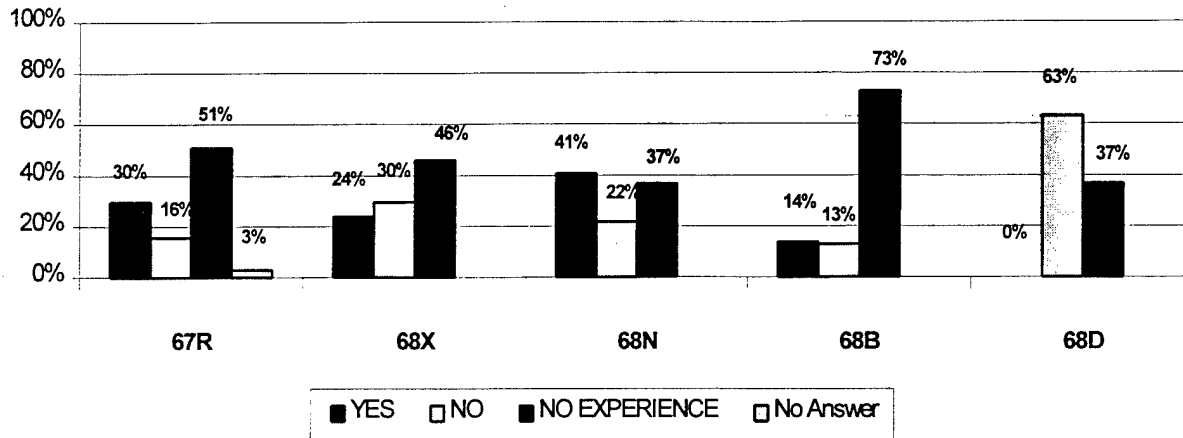
### Problems With MOPP IV Gear While Accessing Aircraft Components

#### MAINTAINER RESPONSES



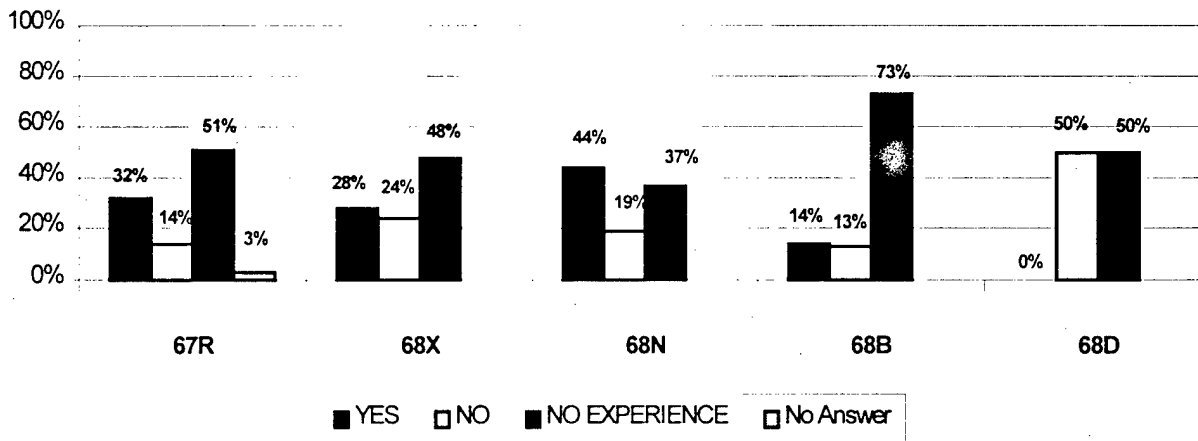
## Problems With MOPP IV Gear While Fastening and Unfastening Component Fasteners

### MAINTAINER RESPONSES



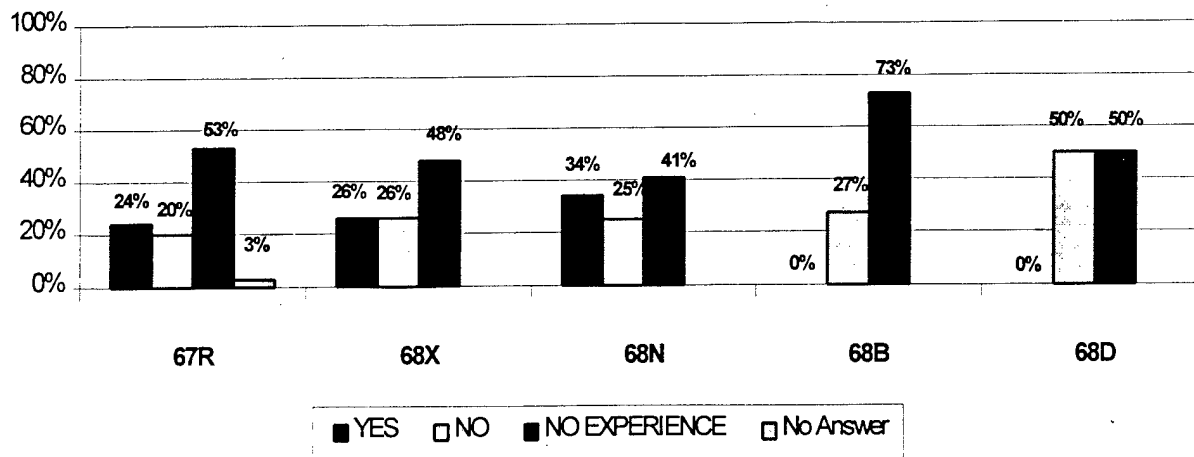
## Problems With MOPP IV Gear While Connecting and Disconnecting Component Connectors

### MAINTAINER RESPONSES



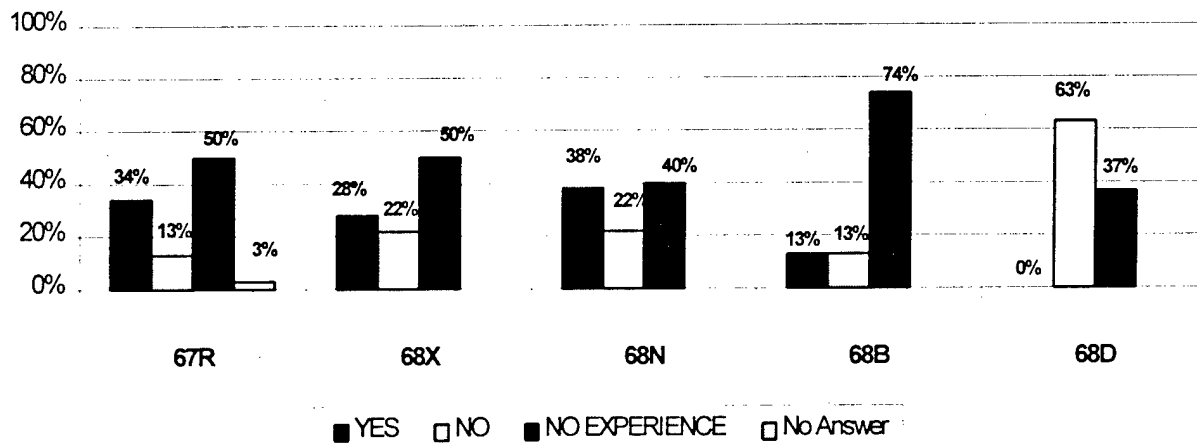
## Problems With MOPP IV Gear While Lifting and Carrying Aircraft Components

### MAINTAINER RESPONSES



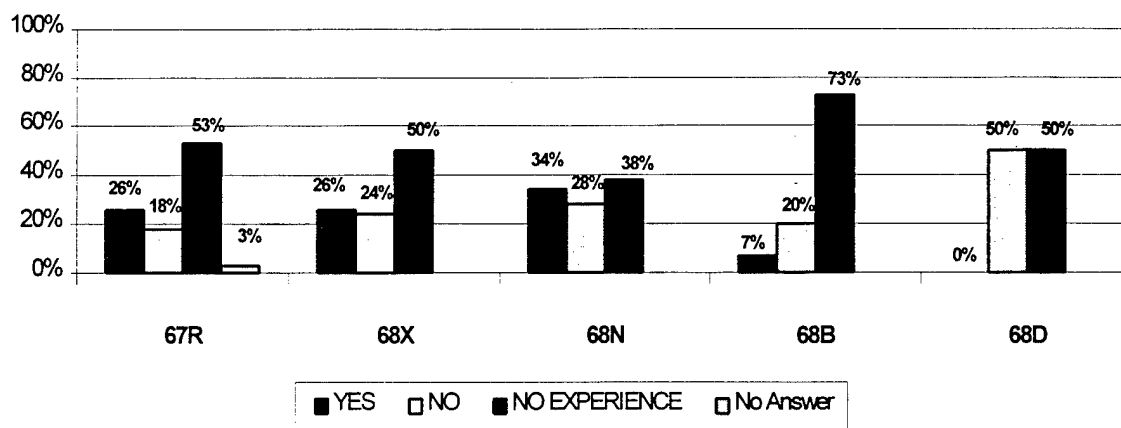
## Problems With MOPP IV Gear While Removing and Replacing Aircraft Components

### MAINTAINER RESPONSES



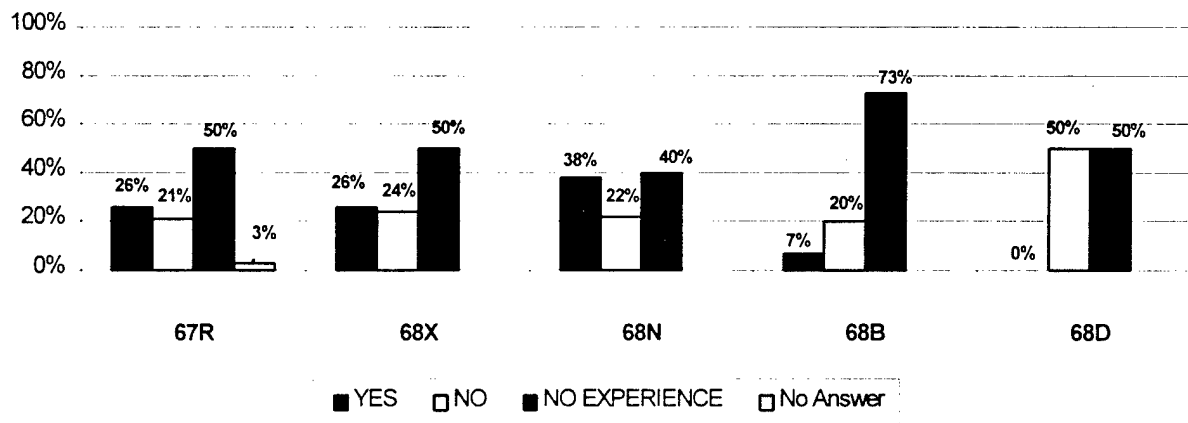
## Problems With MOPP IV Gear While Performing Operational Checks

### MAINTAINER RESPONSES



## Problems With MOPP IV Gear While Inspecting Aircraft Components

### MAINTAINER RESPONSES



## **67R Comments**

### **Problems while wearing MOPP IV gear: (8 Comments)**

Problems seeing components. (3)  
Hard to get to components with MOPP and cold weather gloves on. (2)  
MOPP gear limits sight and feel. (1)  
You cannot fit in a lot of the areas required by the TM in MOPP IV. (1)  
MOPP IV gloves are bulky. (1)

## **68X Comments**

### **Problems with MOPP IV gear. (16 Comments)**

MOPP IV and cold weather gear is awkward and hinders performance. (2)  
Mask makes visibility difficult. (2)  
MOPP gloves tear. (2)  
Impossible to grip connectors with MOPP IV and cold weather gloves. (2)  
Can't fit MOPP IV and cold weather gloves in handles. (2)  
MOPP Gear - while loading munitions in MOPP level 1 during Desert Storm, clothing got caught on pylon-launcher surfaces. (1)  
When performing MOC's in MOPP, you cannot see the IHADSS displays. (1)  
Can't do IHADSS MOC in MOPP 4. (1)  
MOPP IV gear makes it impossible to wire chase. (1)  
Impossible to safety wire with MOPP IV and cold weather gloves on. (1)  
The stuff gets in the way. Try it some time. It will "tick" you off. I know! (1)

## **68N Comments**

### **Problems with MOPP IV gear. (6 Comments)**

APR-39 front receiver fasteners are difficult with MOPP IV, cold weather and combat gear. (2)  
Front APR-39 receiver wearing MOPP IV and cold weather gear. (1)  
Temperature transducers in MOPP IV and cold weather gear. (1)  
MOPP IV gear is cumbersome and restrictive. (1)  
All tasks in MOPP IV are difficult. (1)

## **68B Comments**

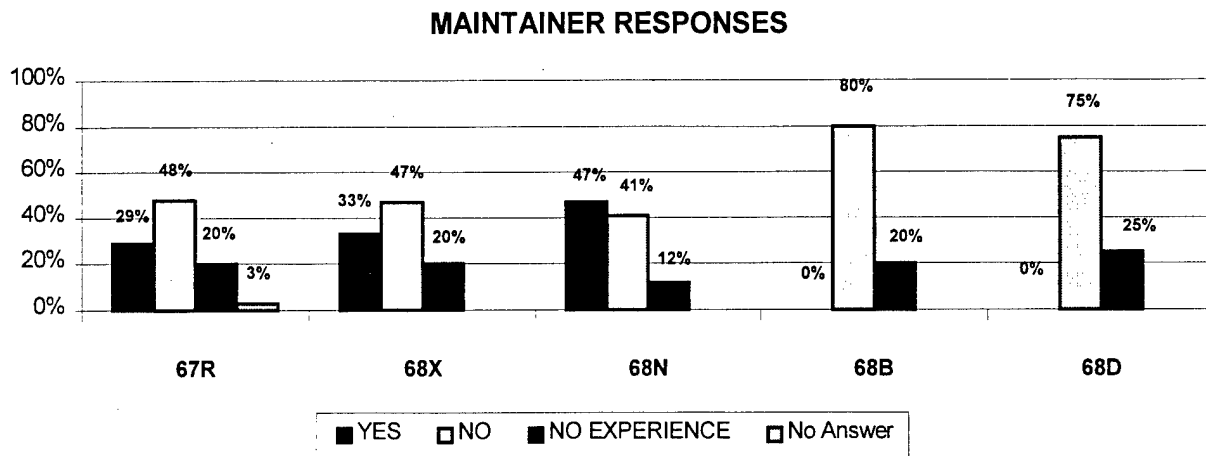
No significant comments.



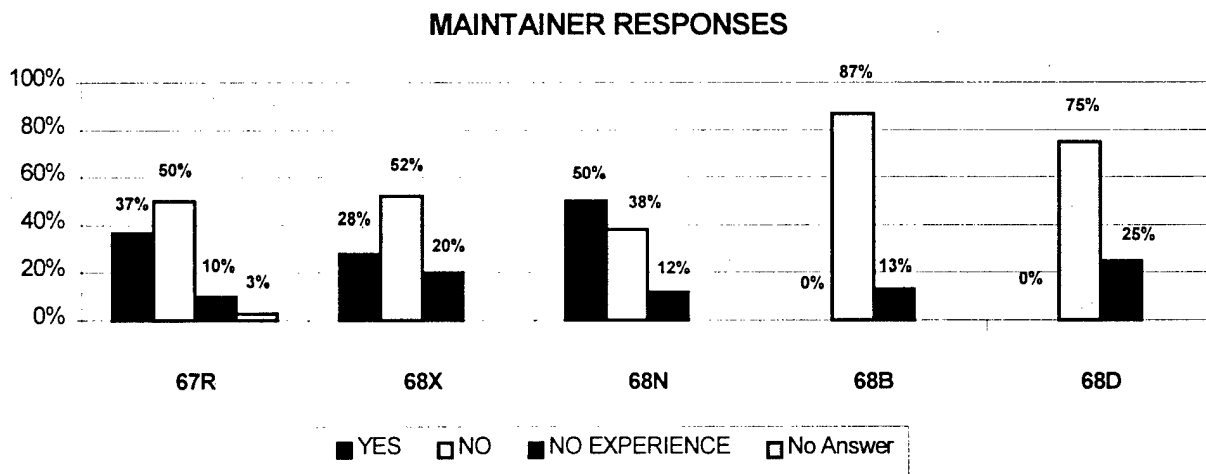
### 68D Comments

No significant comments.

### Problems With Cold Weather Gear While Troubleshooting Aircraft Components

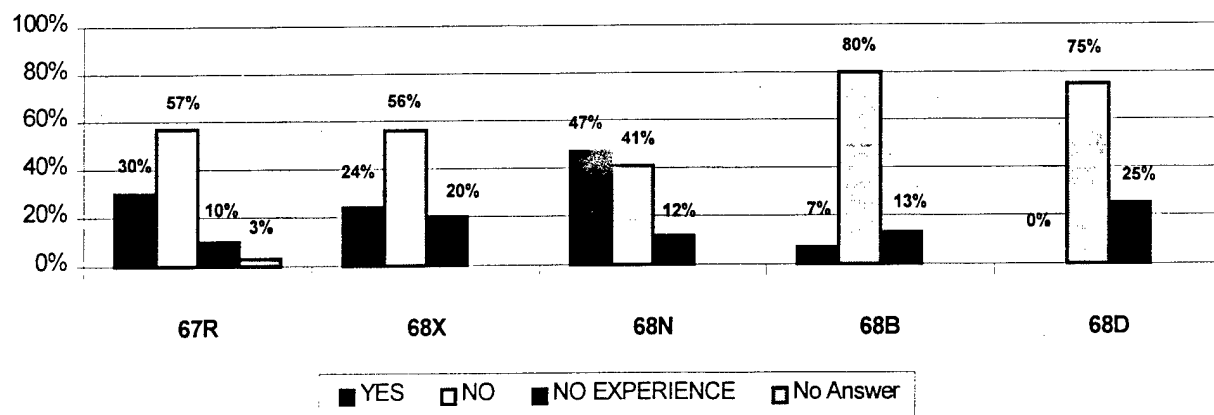


### Problems With Cold Weather Gear While Accessing Aircraft Components



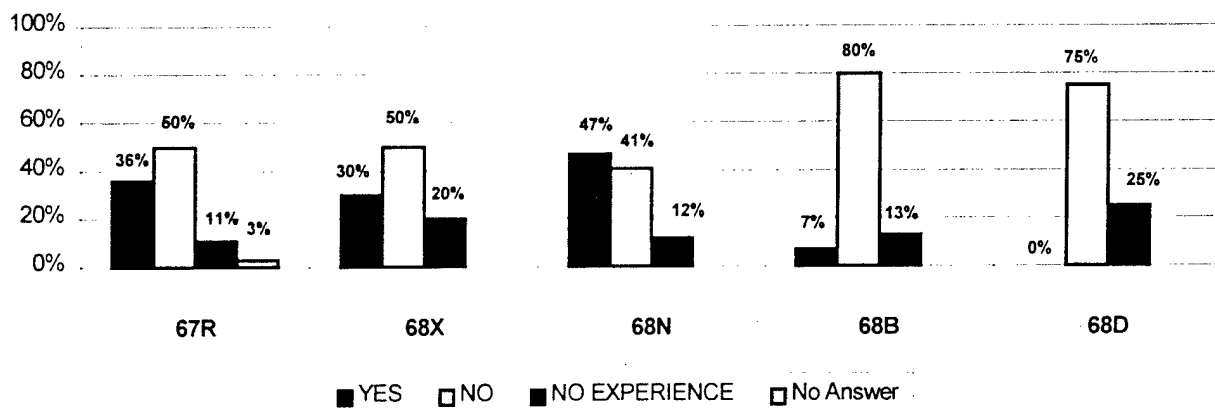
## Problems With Cold Weather Gear While Fastening and Unfastening Aircraft Component Fasteners

### MAINTAINER RESPONSES



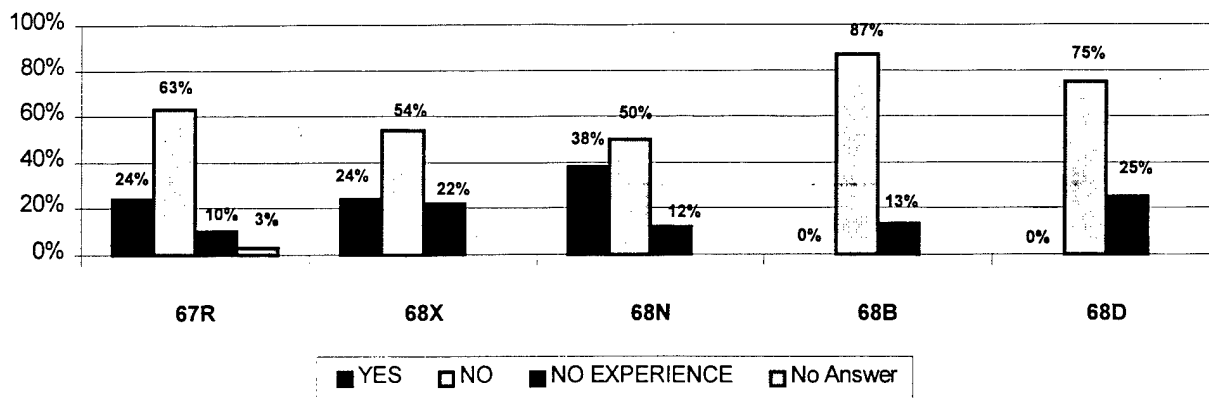
## Problems With Cold Weather Gear While Connecting and Disconnecting Aircraft Component Connectors

### MAINTAINER RESPONSES



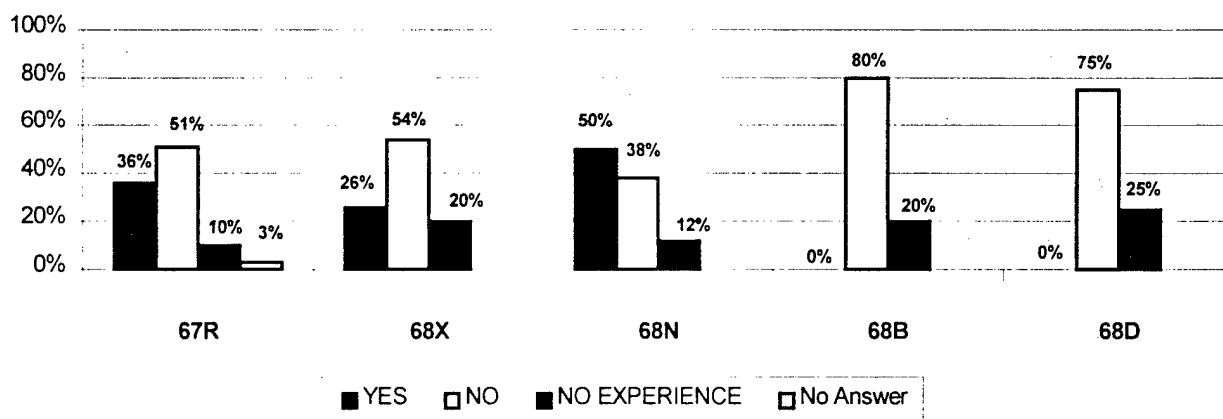
## Problems With Cold Weather Gear While Lifting and Carrying Aircraft Components

### MAINTAINER RESPONSES



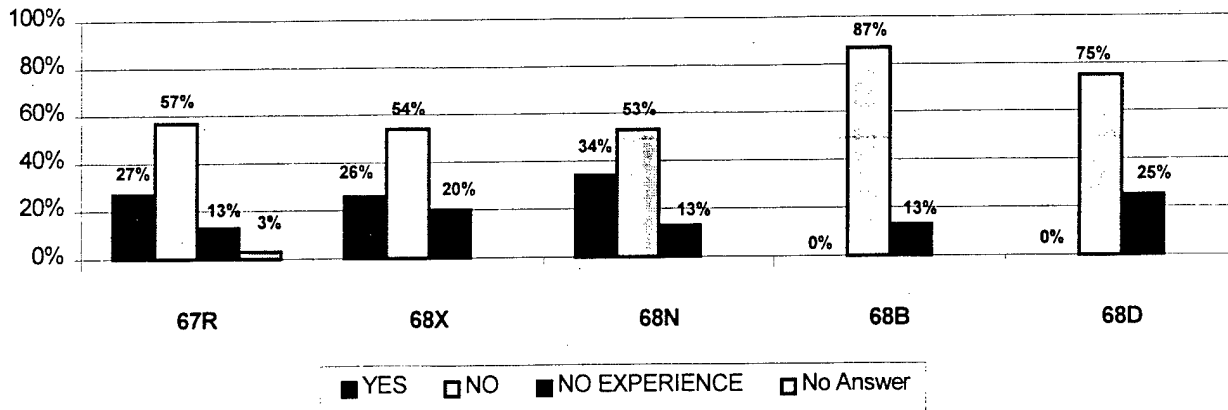
## Problems With Cold Weather Gear While Removing and Replacing Aircraft Components

### MAINTAINER RESPONSES



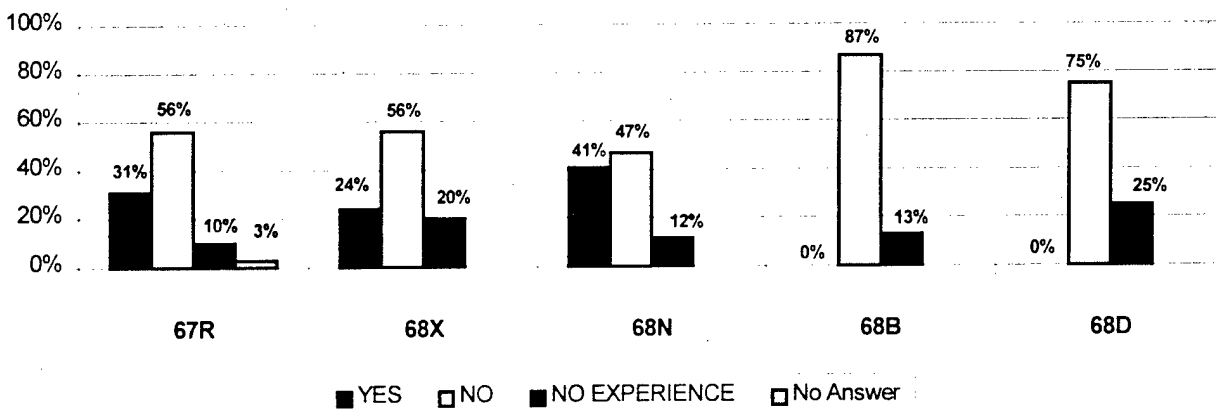
## Problems With Cold Weather Gear While Performing Operational Checks

### MAINTAINER RESPONSES



## Problems With Cold Weather Gear While Inspecting Components

### MAINTAINER RESPONSES



### **67R Comments**

#### **Problems while wearing cold weather gear. (7 Comments).**

Bulk of cold weather gear clothing will limit gaining access due to size of area. (2)

Hard to get to components with MOPP and cold weather gloves on. (2)

All cold weather and combat gear. (1)

While using cold weather gear, you cannot access the strap pack as well as in BDU's. (1)

Cold weather gloves are bulky. (1)

### **68X Comments**

#### **Problems with cold weather gear. (10 Comments.)**

Impossible to grip connectors with MOPP IV and cold weather gloves. (2)

Can't fit MOPP IV and cold weather gloves in handles. (2)

MOPP IV and cold weather gear is awkward and hinders performance. (2)

The stuff gets in the way. Try it some time. It will "tick" you off. I know!! (1)

Cold weather gear makes it impossible to wire chase. (1)

Cold weather gloves don't fit with handles and parts slip when you grab them. (1)

Impossible to safety wire with MOPP IV and cold weather gloves on. (1)

### **68N Comments**

#### **Cold weather gear restrictive. (8)**

APR-39 front receiver fasteners are difficult with cold weather and combat gear. (2)

Wearing cold weather gear restricts workspace. (2)

Too bulky. (1)

Can't work with cold weather gloves. (1)

Front APR-39 receiver wearing MOPP IV and cold weather gear. (1)

Temperature transducers in MOPP IV and cold weather gear. (1)

### **68B Comments**

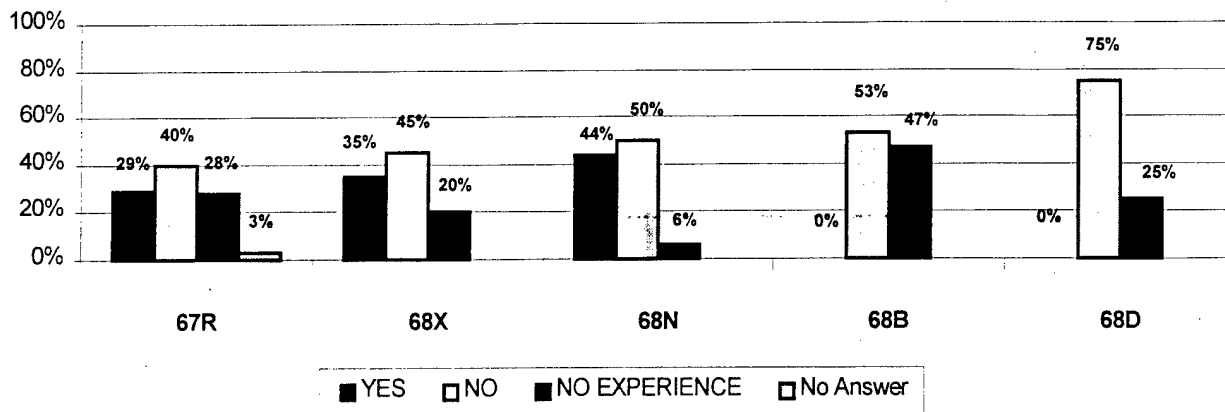
No significant comments.

### **68D Comments**

No significant comments.

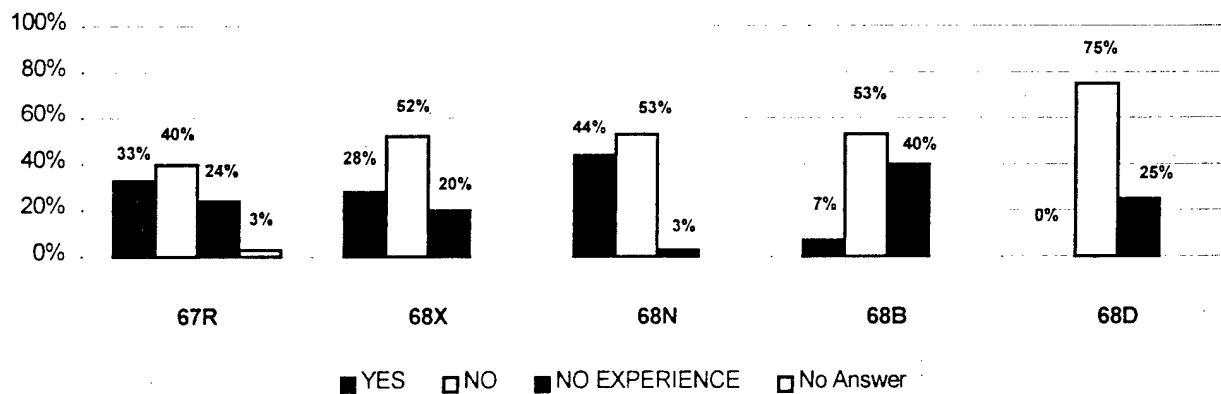
## Problems With Combat Gear While Troubleshooting Aircraft Components

### MAINTAINER RESPONSES



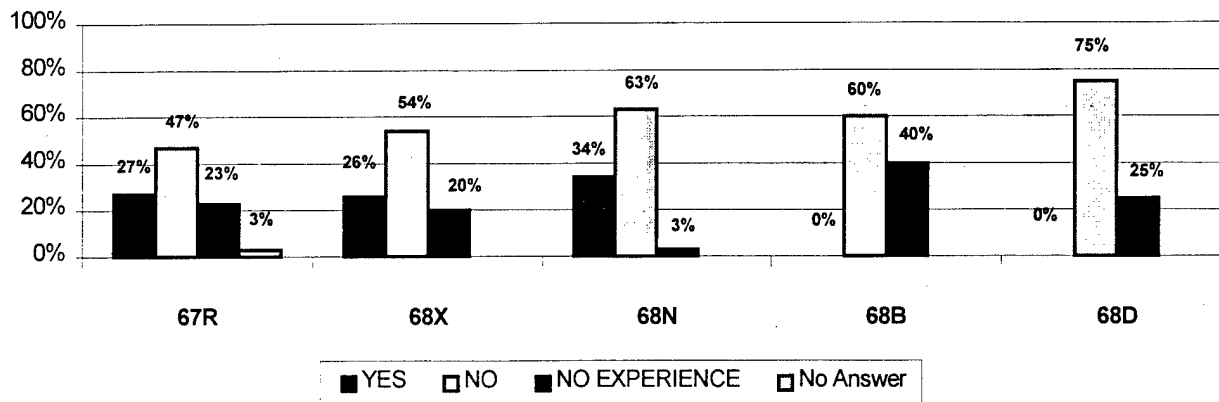
## Problems With Combat Gear While Accessing Aircraft Components

### MAINTAINER RESPONSES



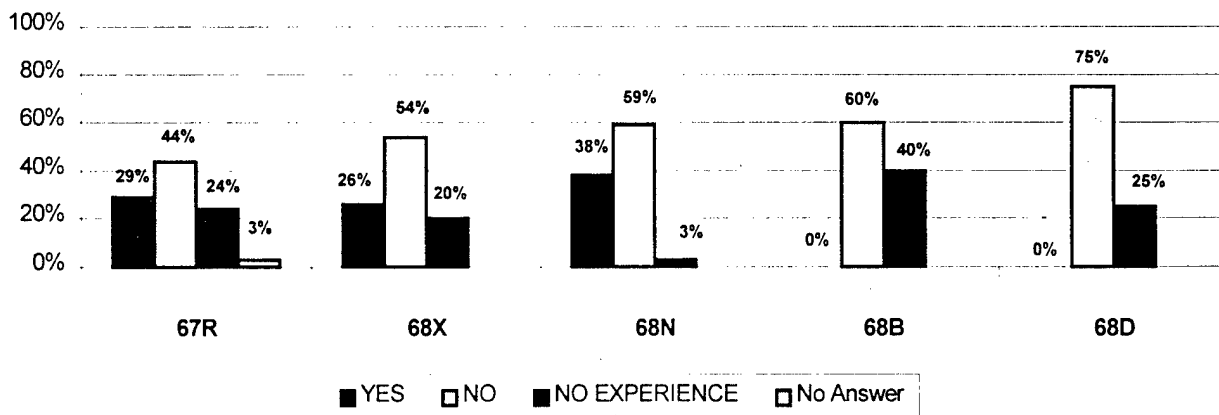
## Problems With Combat Gear While Fastening and Unfastening Aircraft Component Fasteners

### MAINTAINER RESPONSES



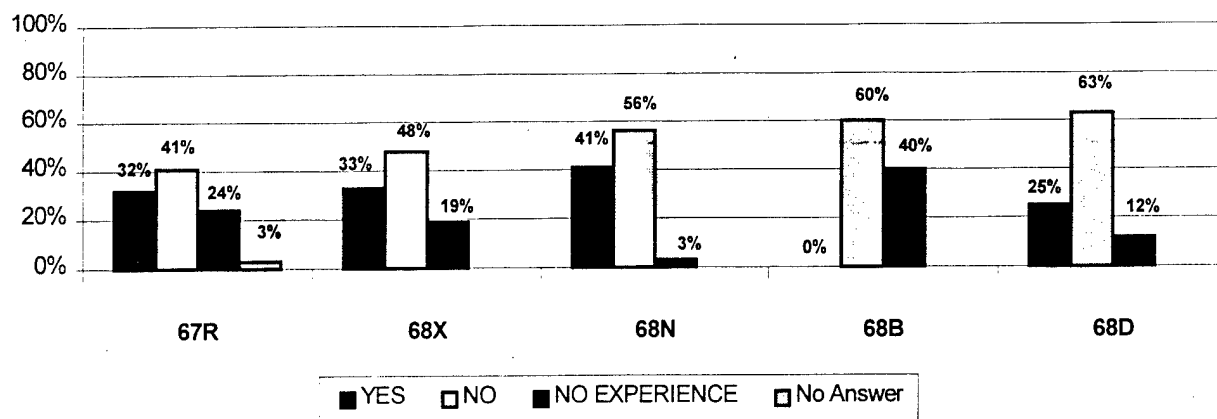
## Problems With Combat Gear While Connecting and Disconnecting Aircraft Component Connectors

### MAINTAINER RESPONSES



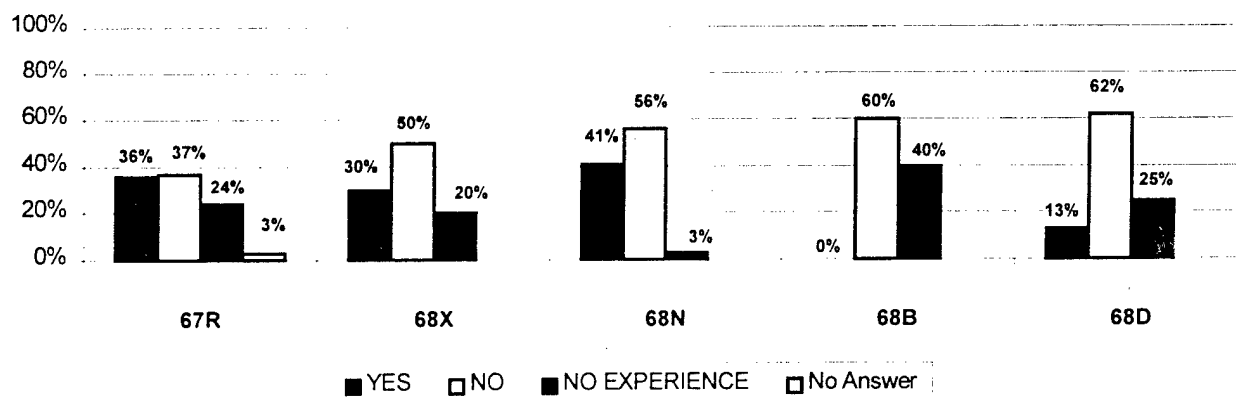
## Problems With Combat Gear While Lifting and Carrying Aircraft Components

### MAINTAINER RESPONSES



## Problems With Combat Gear While Removing and Replacing Aircraft Components

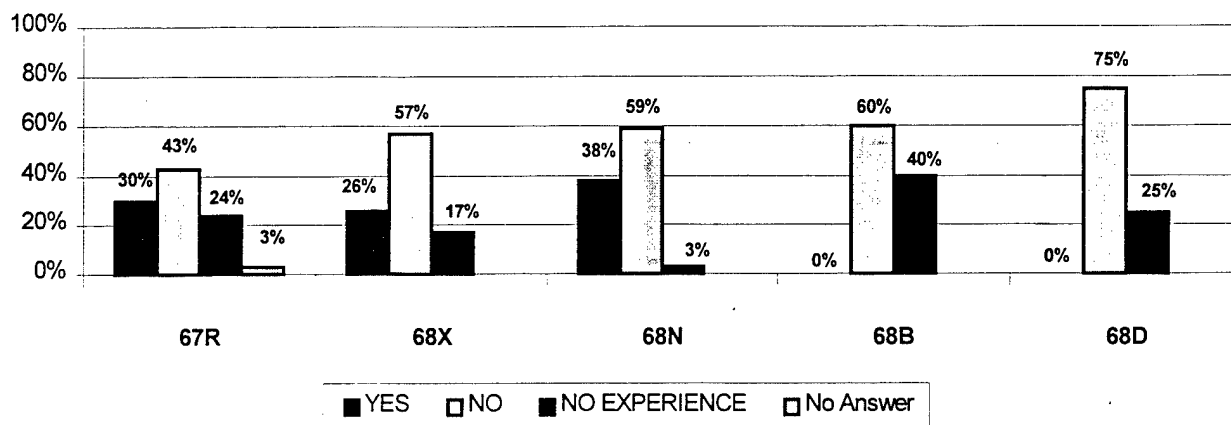
### MAINTAINER RESPONSES





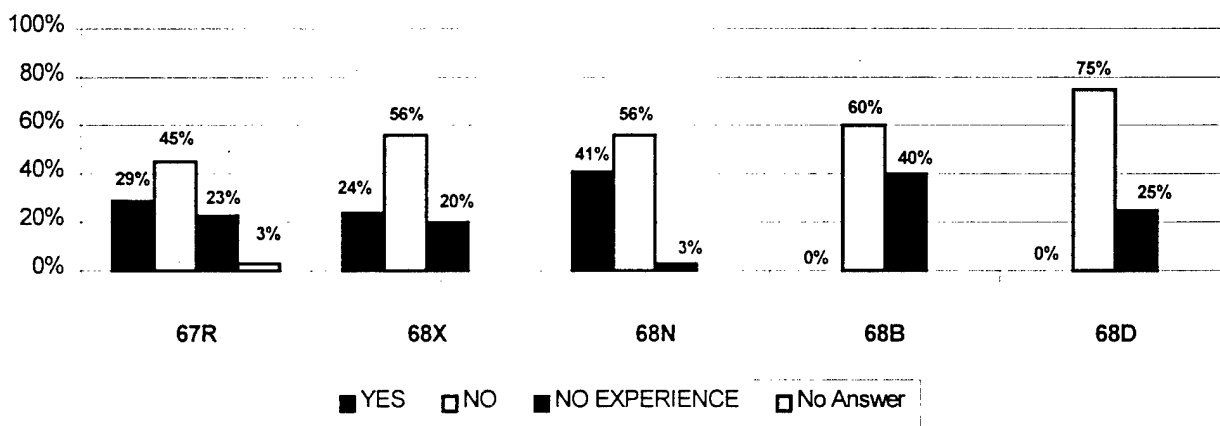
## Problems With Combat Gear While Performing Operational Checks

### MAINTAINER RESPONSES



## Problems With Combat Gear While Inspecting Components

### MAINTAINER RESPONSES



### **67R Comments**

#### **Problems while wearing combat gear: (5 Comments)**

Combat gear gets hung-up on panels and wires, breaking them occasionally. (2)

Too much hanging on you (straps, bulky clothing, weapons, etc.). (1)

Combat gear get in the way. (1)

All cold weather and combat gear. (1)

### **68X Comments**

No significant comments.

### **68N Comments**

#### **Problems while wearing combat gear. (4 Comments)**

Combat gear makes critical maneuvering and visual inspection impossible. (2)

APR-39 front receiver fasteners are difficult with cold weather and combat gear. (2)

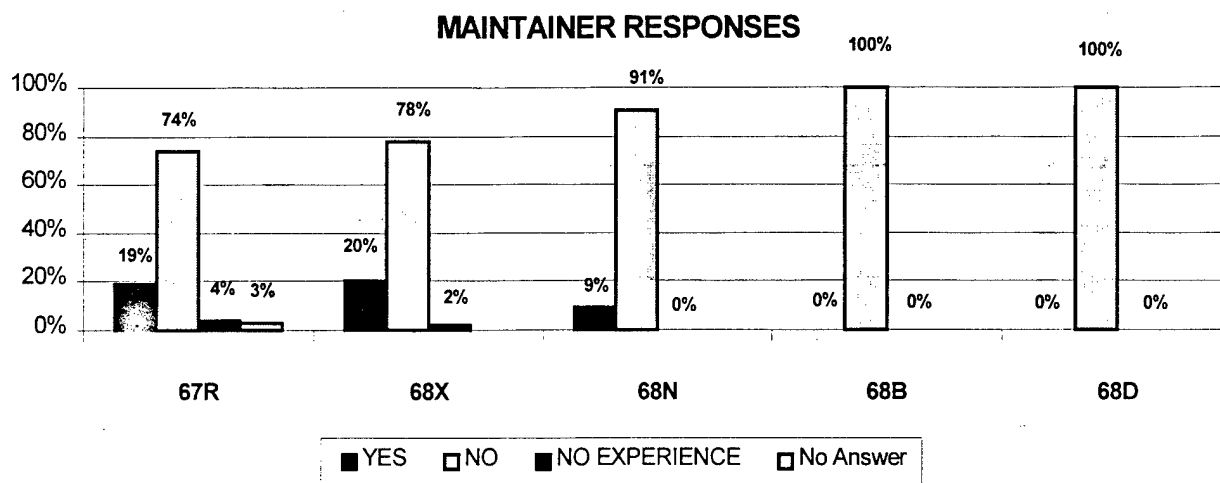
### **68B Comments**

No significant comments.

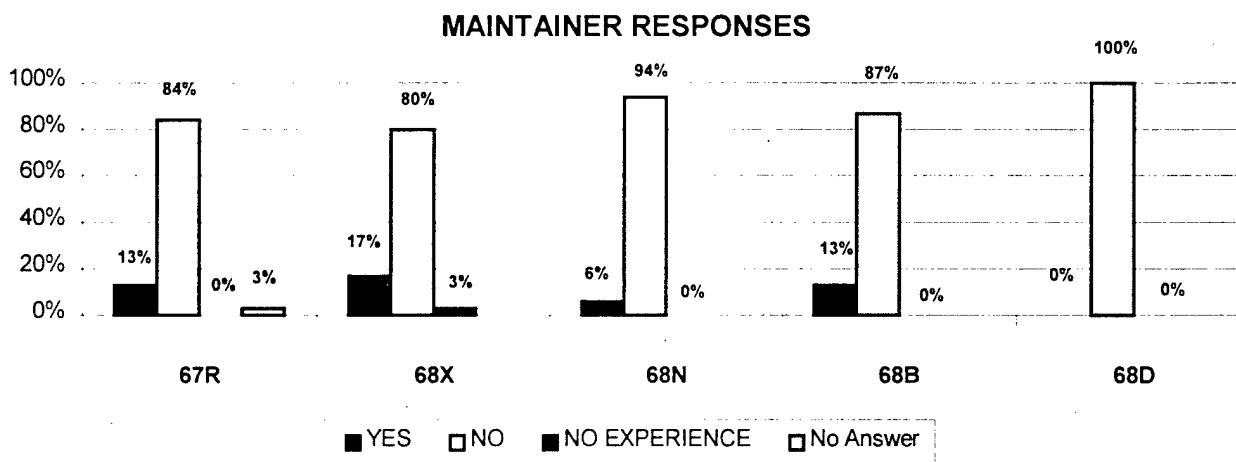
### **68D Comments**

No significant comments.

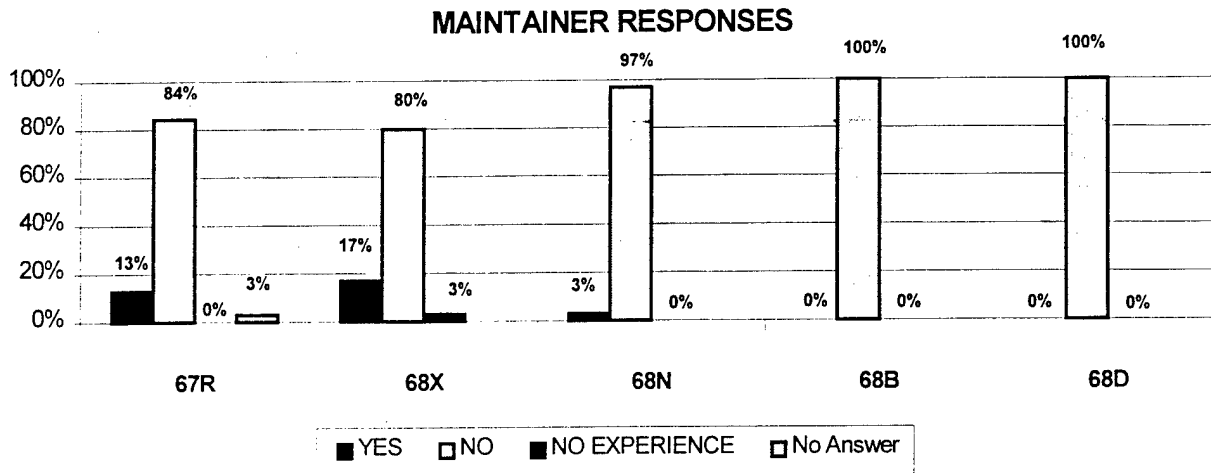
## Problems With BDU While Troubleshooting Aircraft Components



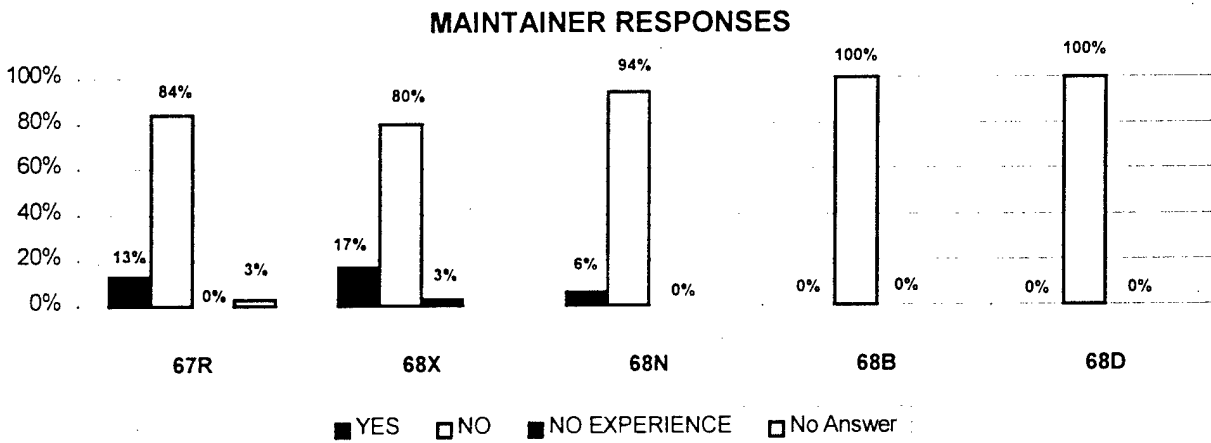
## Problems With BDU While Accessing Aircraft Components



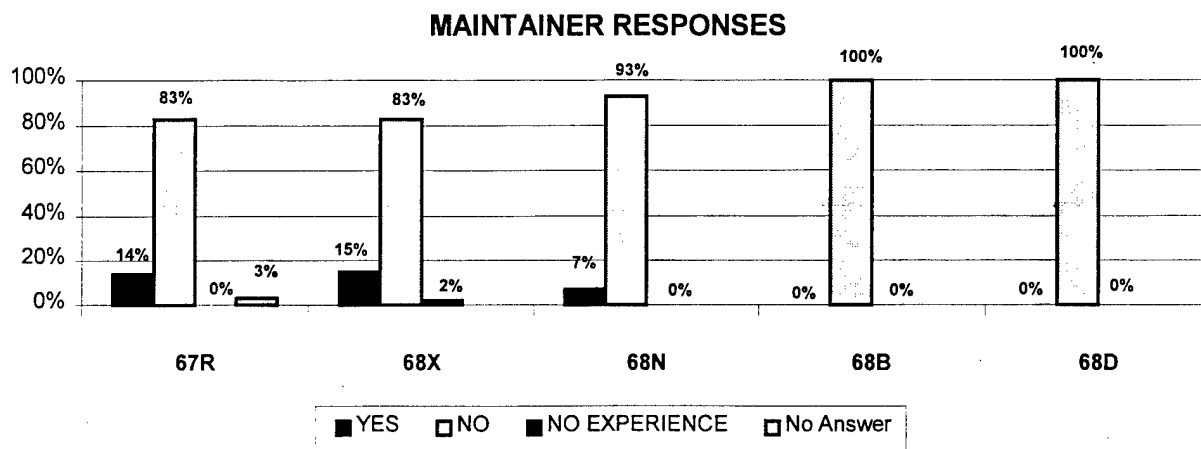
**Problems With BDU While Fastening and Unfastening Aircraft Component Fasteners**



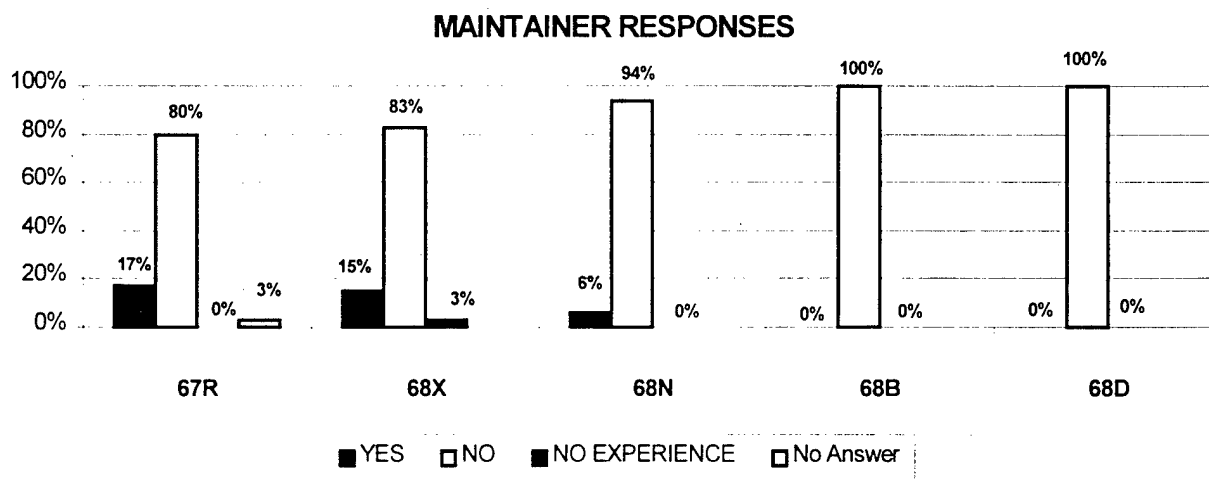
**Problems With BDU While Connecting and Disconnecting Aircraft Component Connectors**



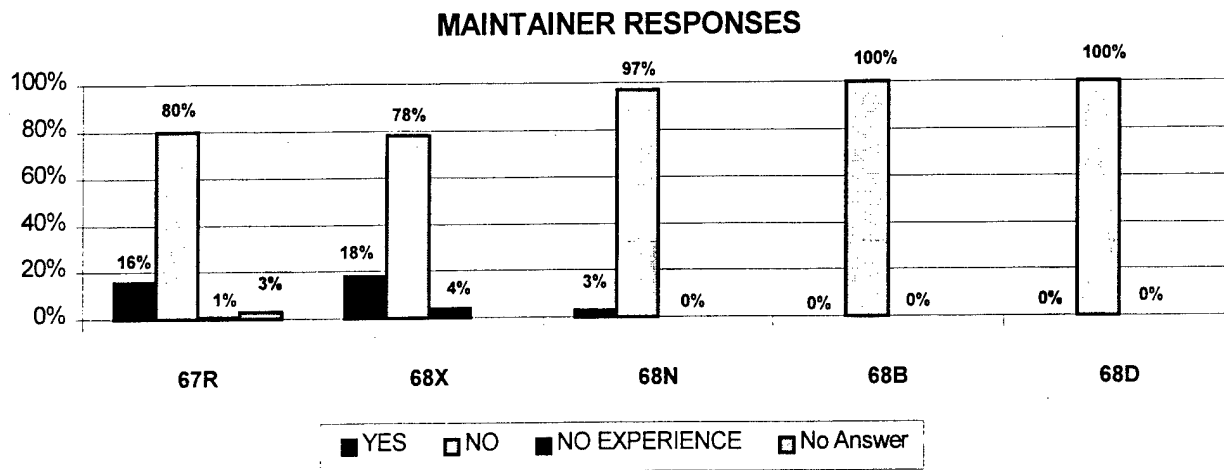
## Problems With BDU While Lifting and Carrying Aircraft Components



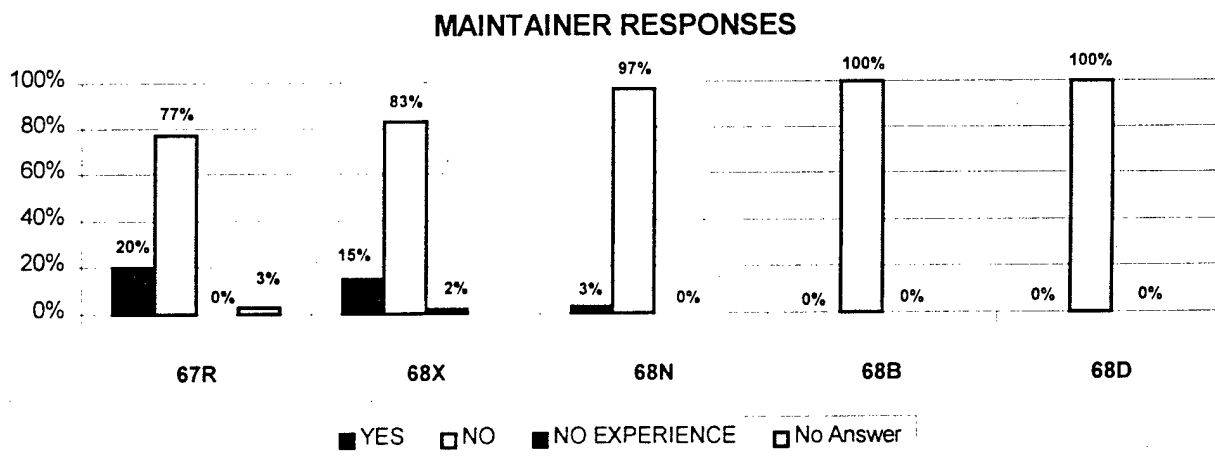
## Problems With BDU While Removing and Replacing Aircraft Components



## Problems With BDU While Performing Operational Checks



## Problems With BDU While Inspecting Components



### **67R Comments**

No significant comments.

### **68X Comments**

Problems with BDU's. (5 Comments).

Fluids get on BDU. (1)

Connecting hydraulic lines while wearing BDU. (1)

Lifting generator with BDU. (1)

Lifting 30mm gun with BDU. (1)

Lifting turret with BDU. (1)

### **67N Comments**

No significant comments.

### **67B Comments**

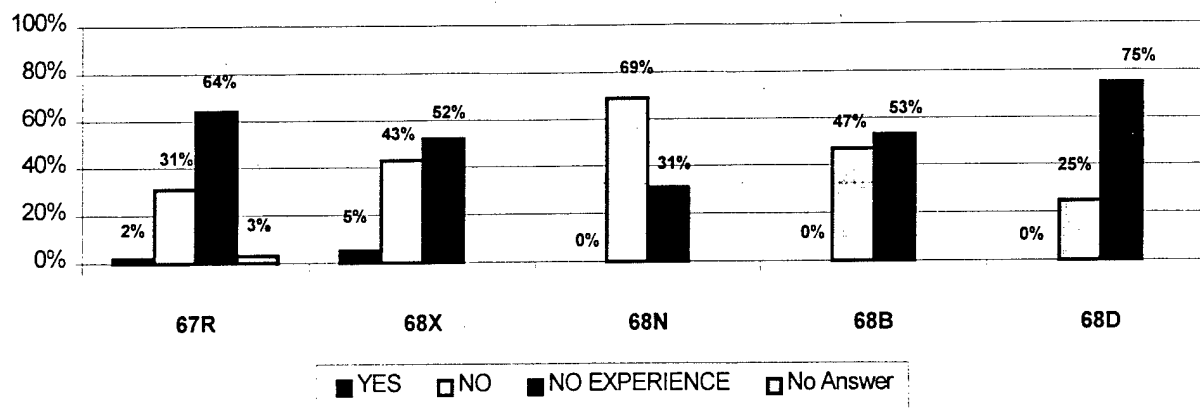
No significant comments.

### **67D Comments**

No significant comments.

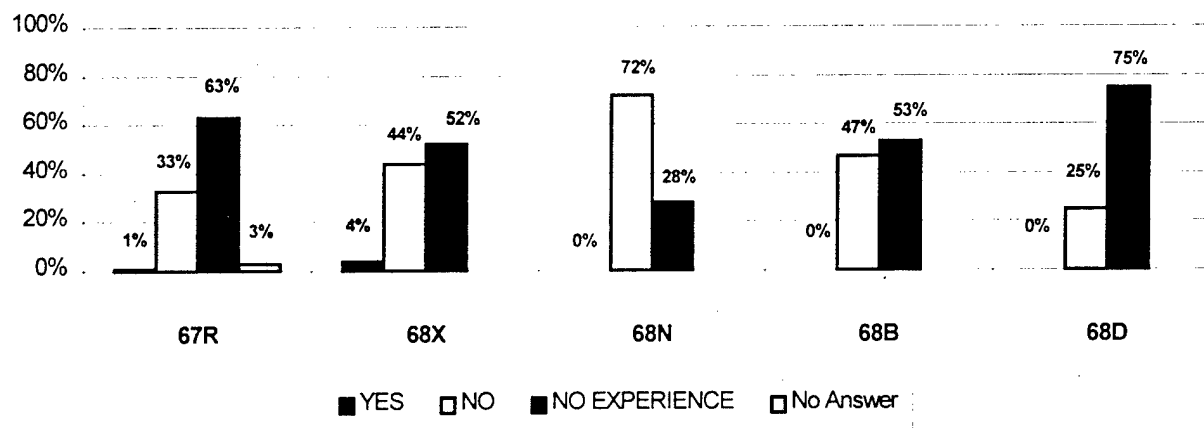
## Problems With Shop Coveralls While Troubleshooting Aircraft Components

### MAINTAINER RESPONSES



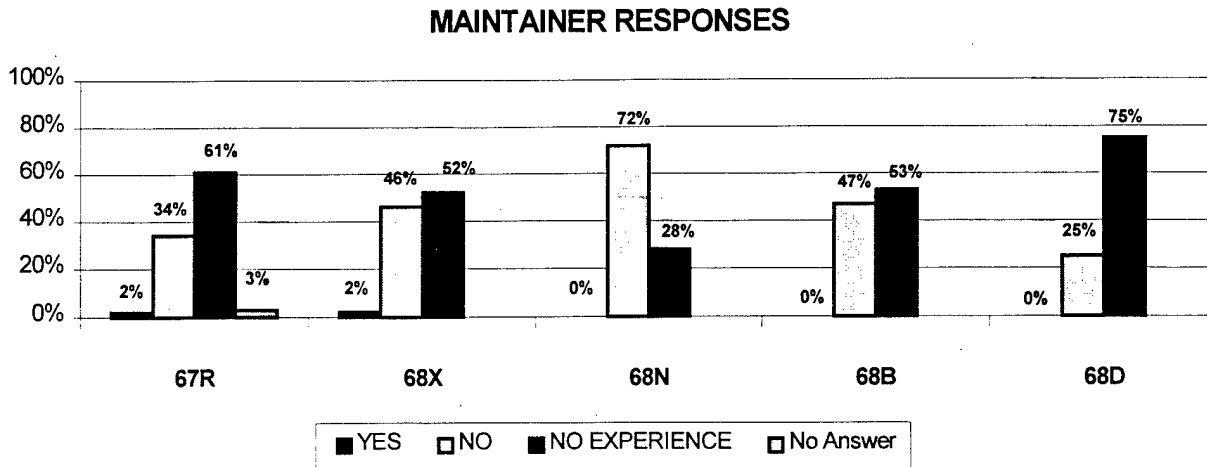
## Problems With Shop Coveralls While Accessing Aircraft Components

### MAINTAINER RESPONSES

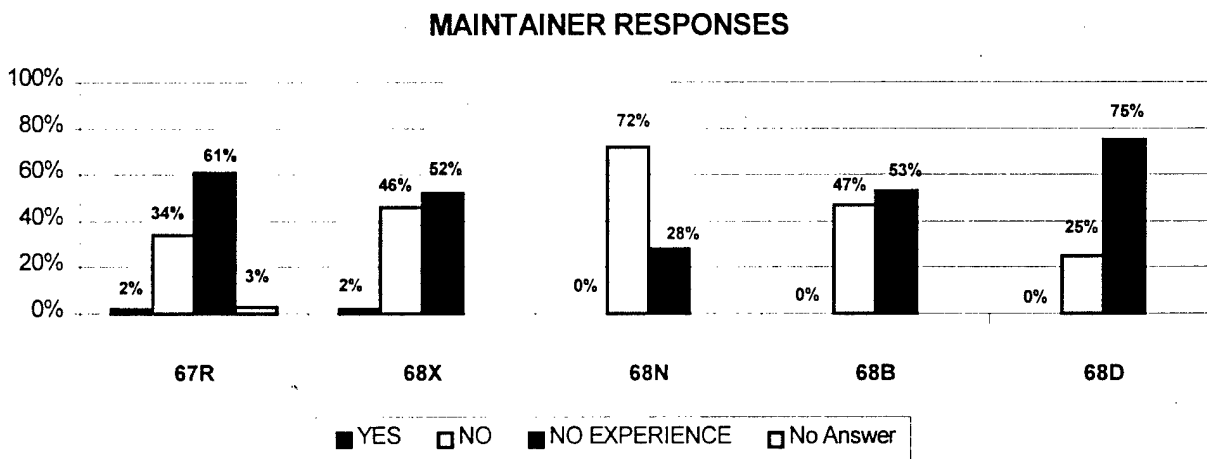




**Problems With Shop Coveralls While Fastening and Unfastening Aircraft Component Fasteners**

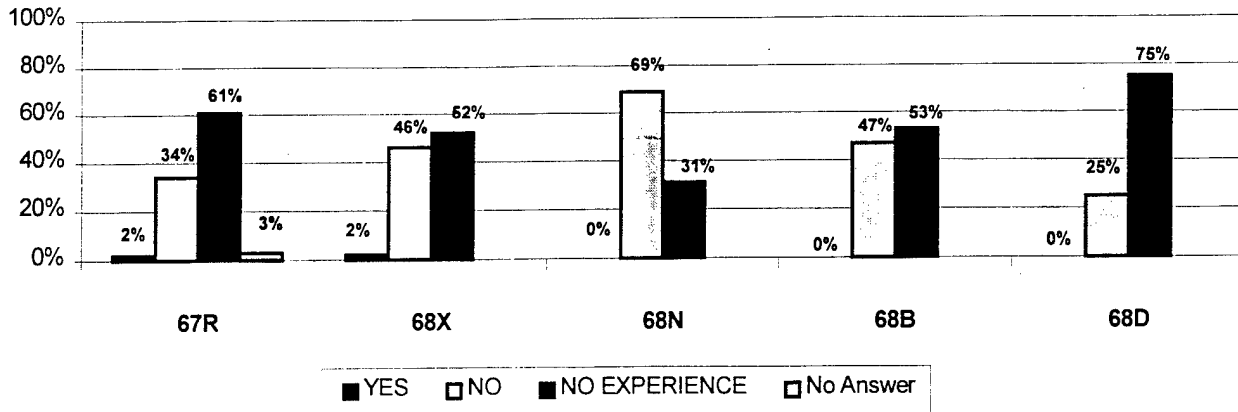


**Problems With Shop Coveralls While Connecting and Disconnecting Aircraft Component Connectors**



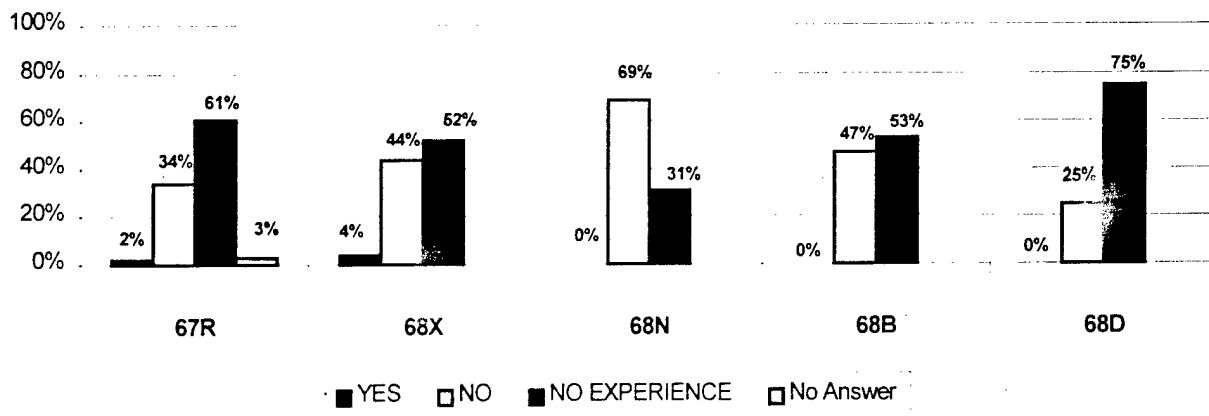
## Problems With Shop Coveralls While Lifting and Carrying Aircraft Components

### MAINTAINER RESPONSES



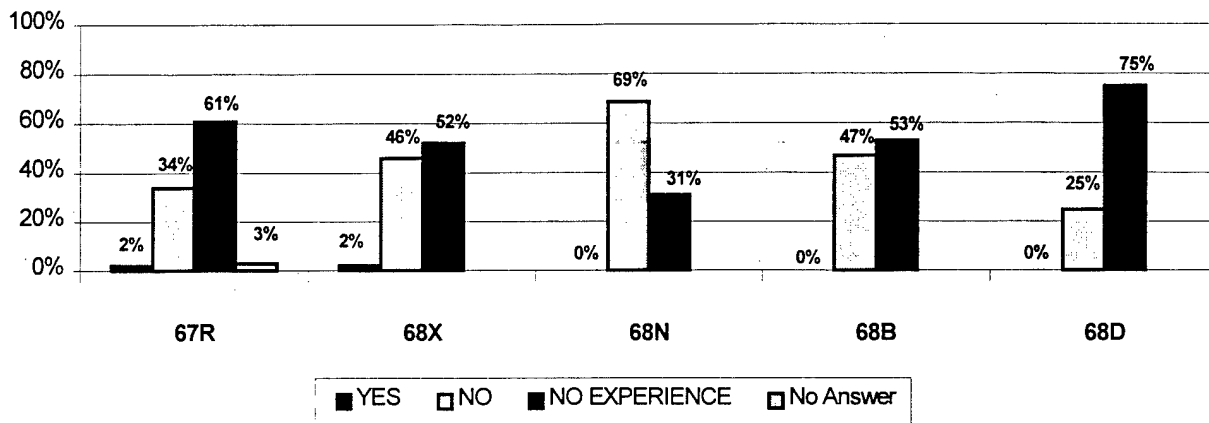
## Problems With Shop Coveralls While Removing and Replacing Aircraft Components

### MAINTAINER RESPONSES



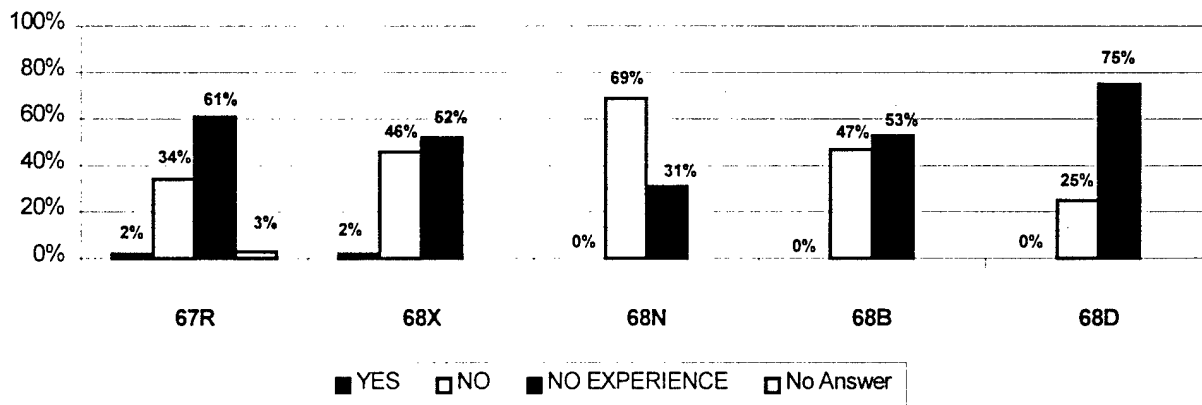
## Problems With Shop Coveralls While Performing Operational Checks

### MAINTAINER RESPONSES



## Problems With Shop Coveralls While Inspecting Components

### MAINTAINER RESPONSES



**67R Comments**

No significant comments.

**67X Comments**

No significant comments.

**67N Comments**

No significant comments.

**67B Comments**

No significant comments.

**67D Comments**

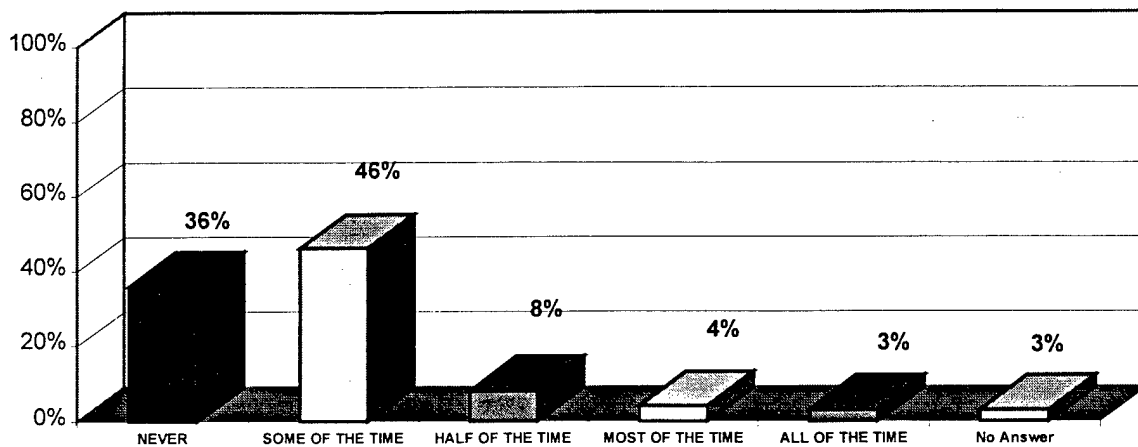
No significant comments.

## MANPOWER REQUIREMENTS

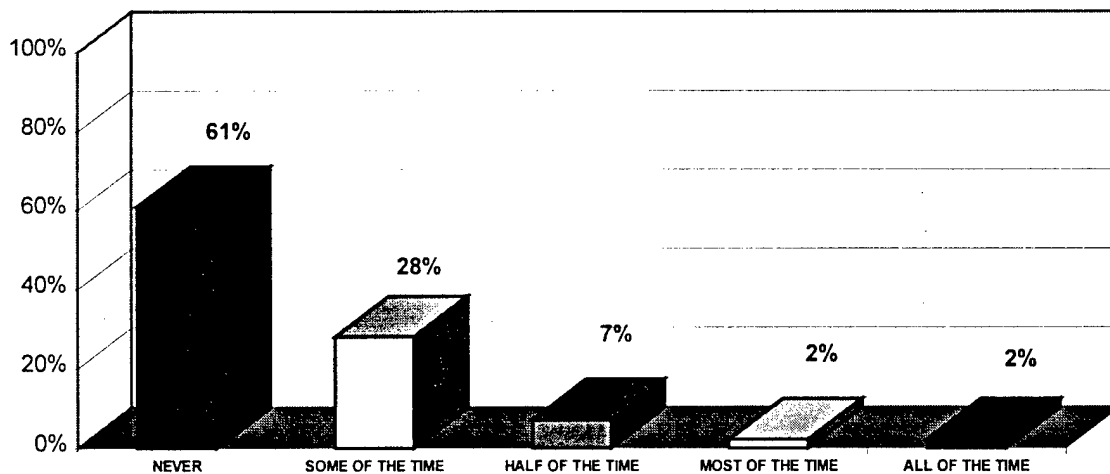
**MR1. How often do you need MORE personnel than specified in the Technical Manual to assist you in performing the following tasks?**

### TROUBLESHOOTING AIRCRAFT COMPONENTS

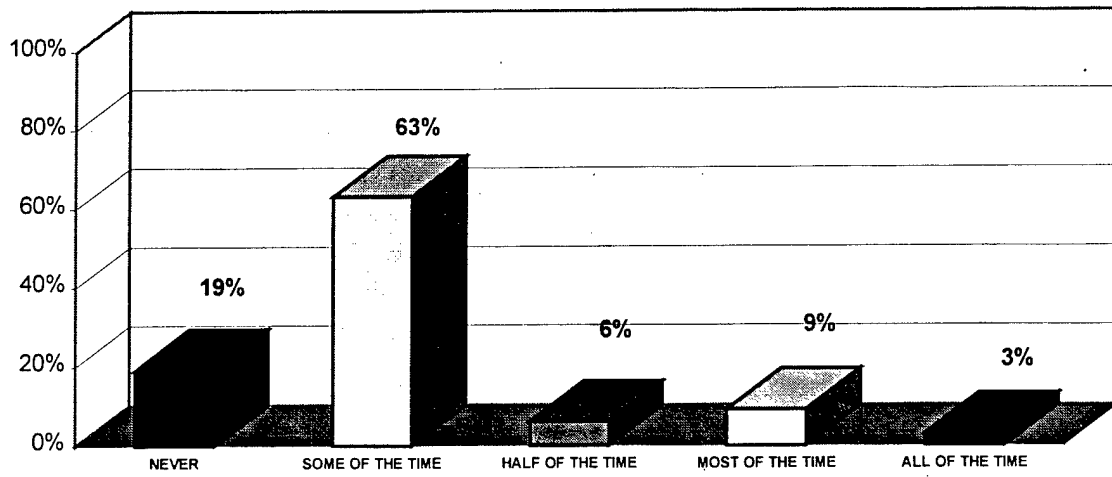
**67R RESPONSES**



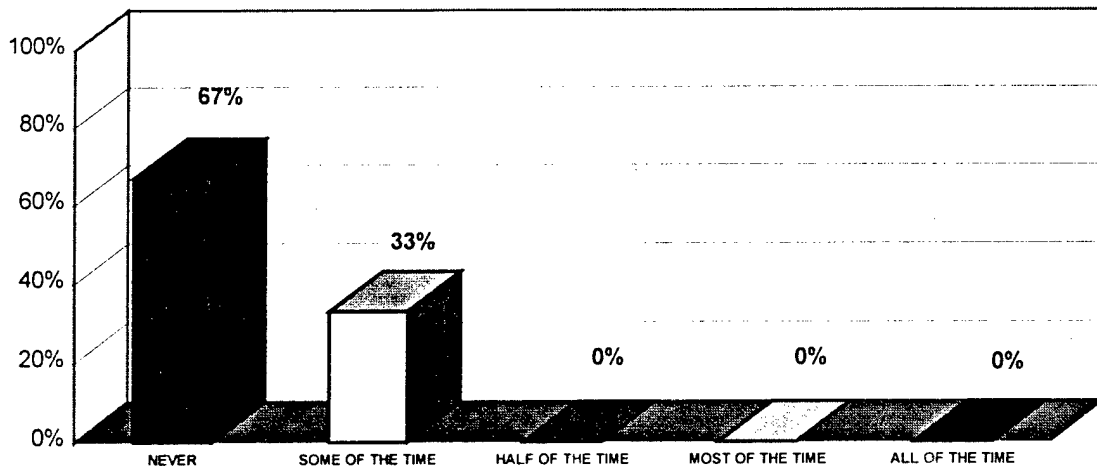
**68X RESPONSES**



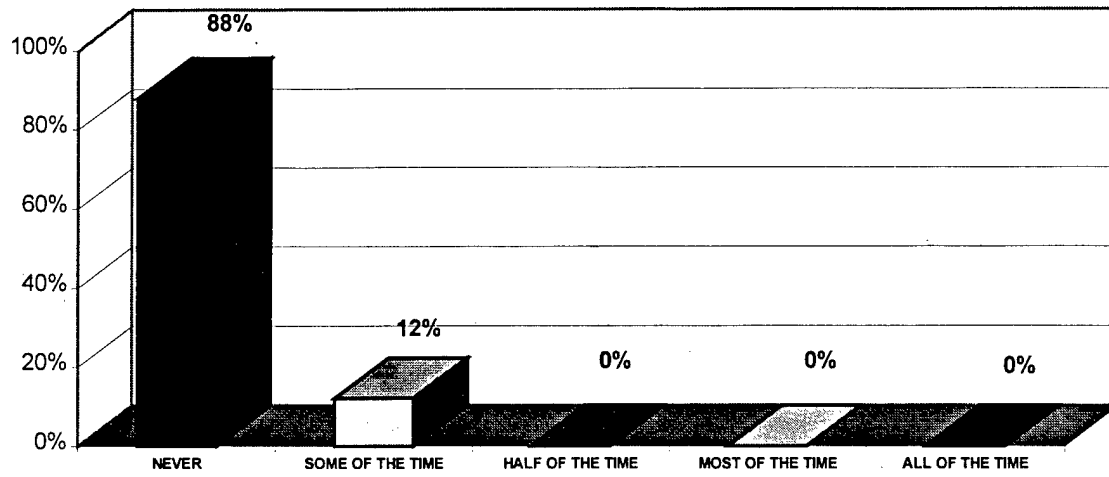
**68N RESPONSES**



**68B RESPONSES**

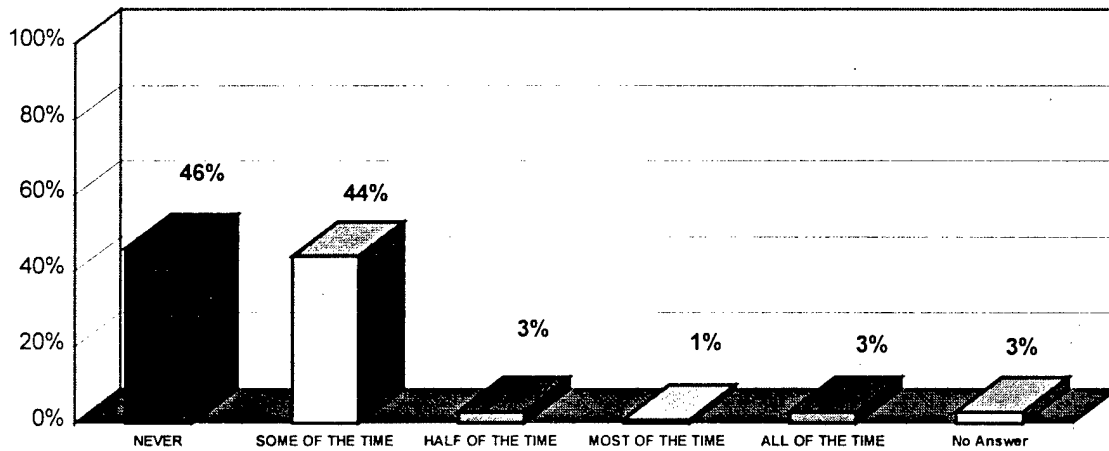


### 68D RESPONSES

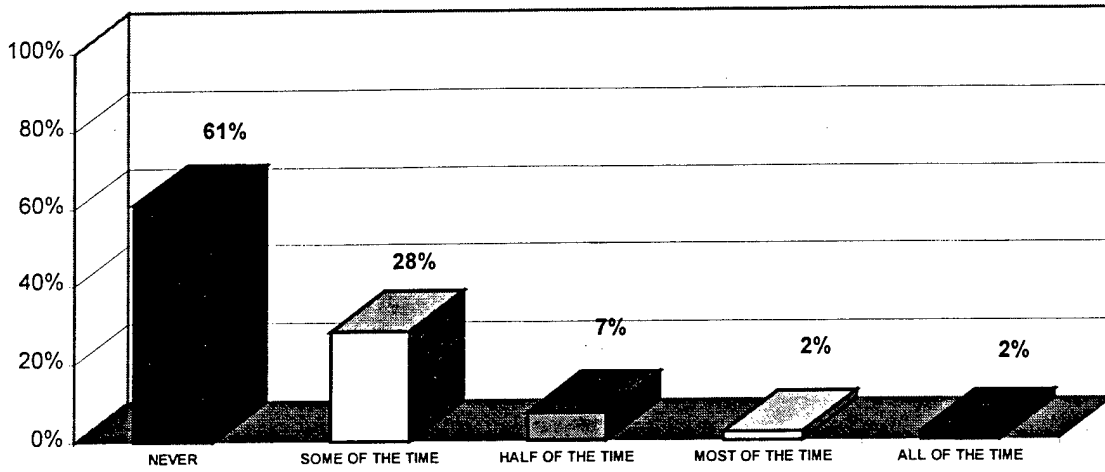


### ACCESSING AIRCRAFT COMPONENTS

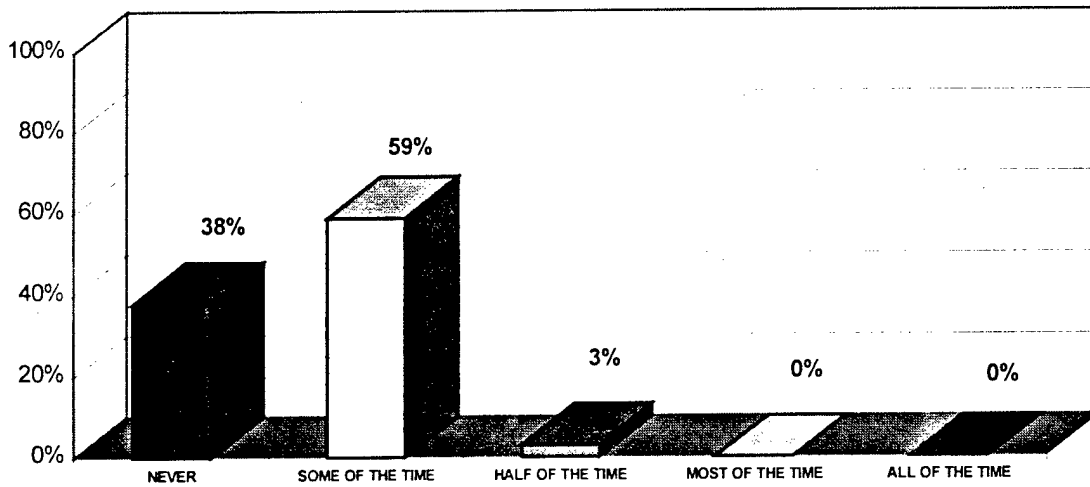
### 67R RESPONSES



### 68X RESPONSES

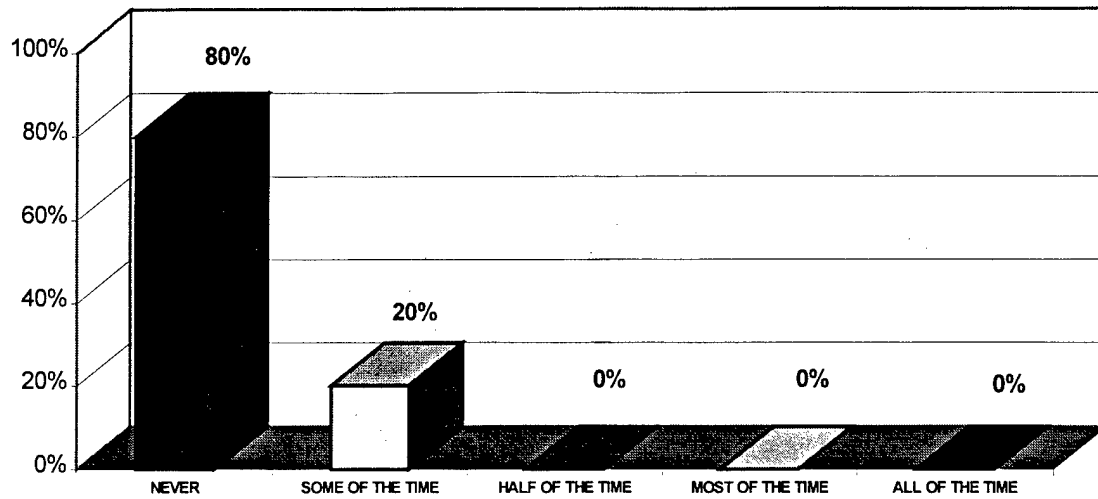


### 68N RESPONSES

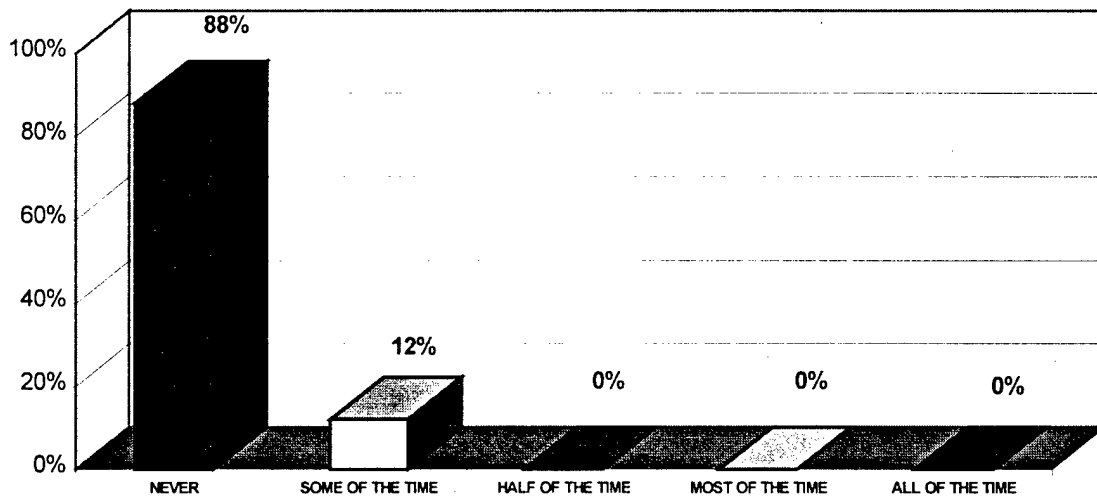




### 68B RESPONSES

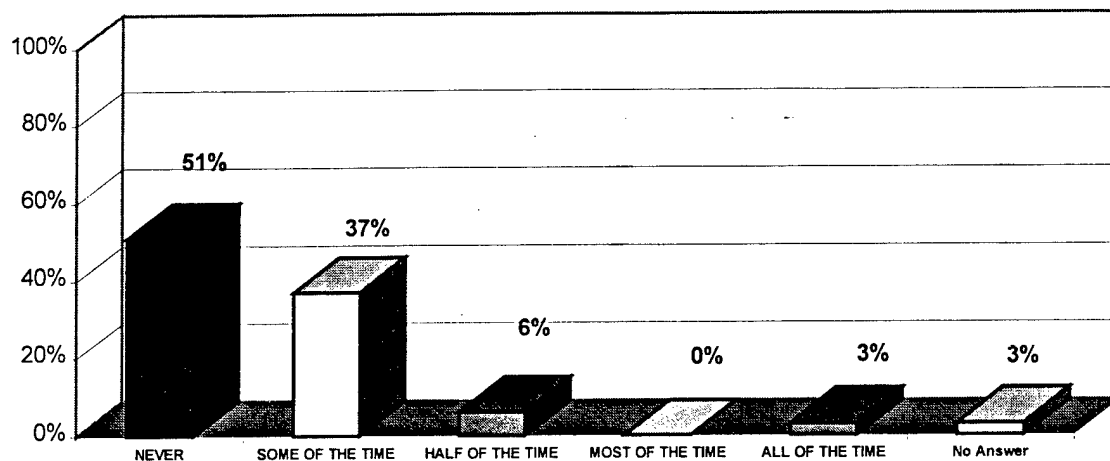


### 68D RESPONSES

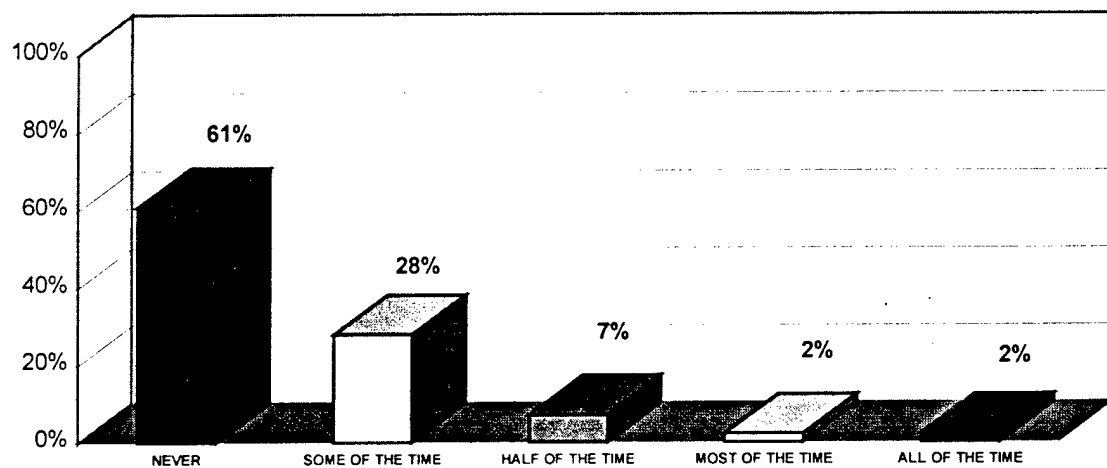


## FASTENING AND UNFASTENING COMPONENT CONNECTORS

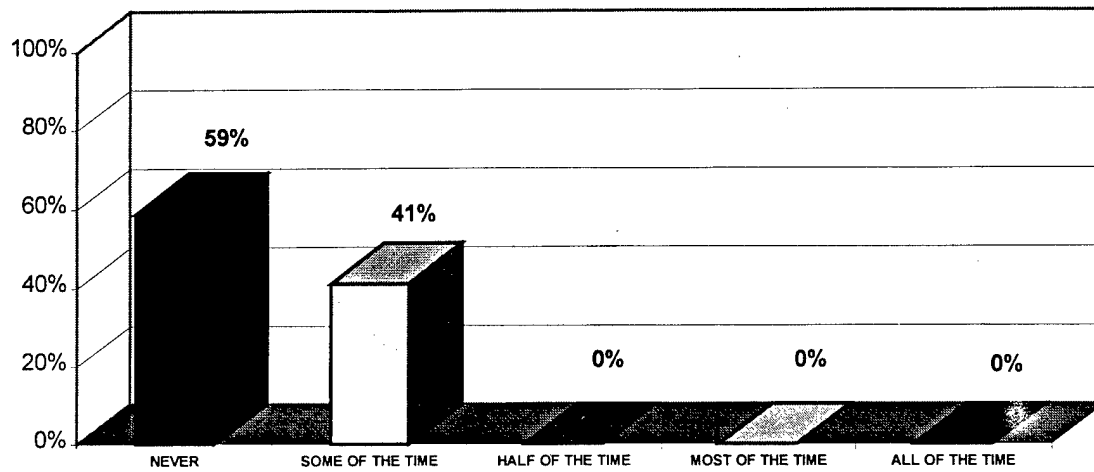
**67R RESPONSES**



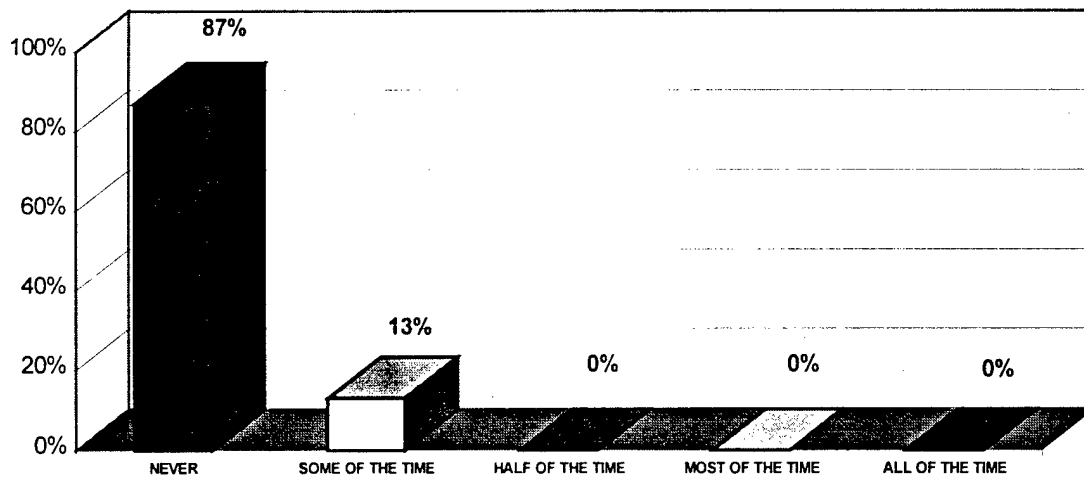
**68X RESPONSES**

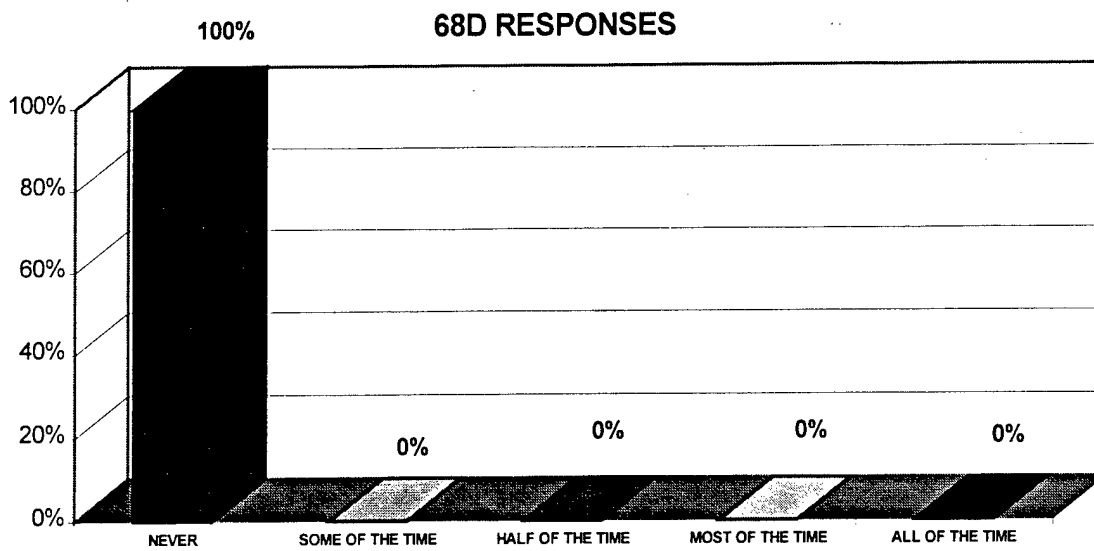


### 68N RESPONSES

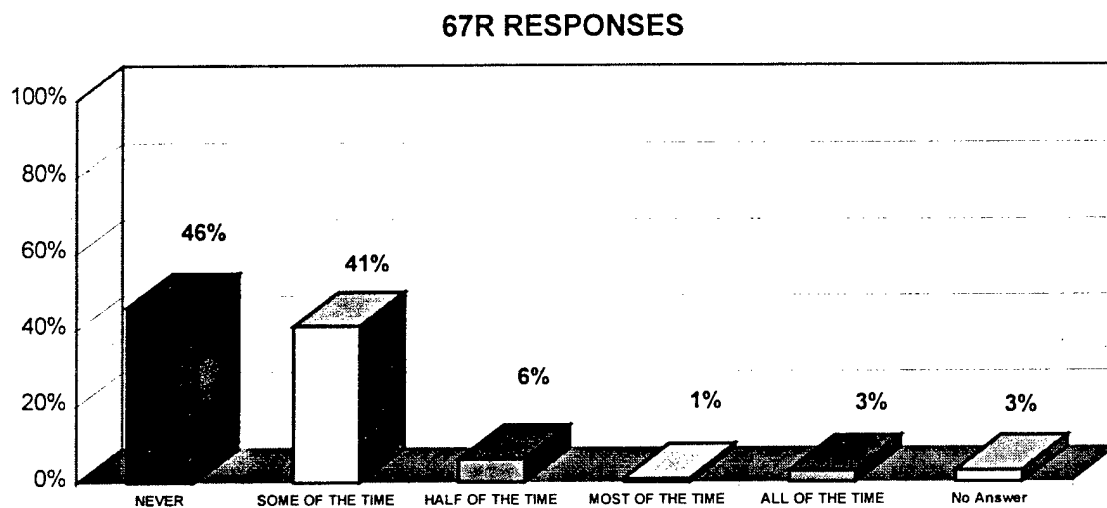


### 68B RESPONSES

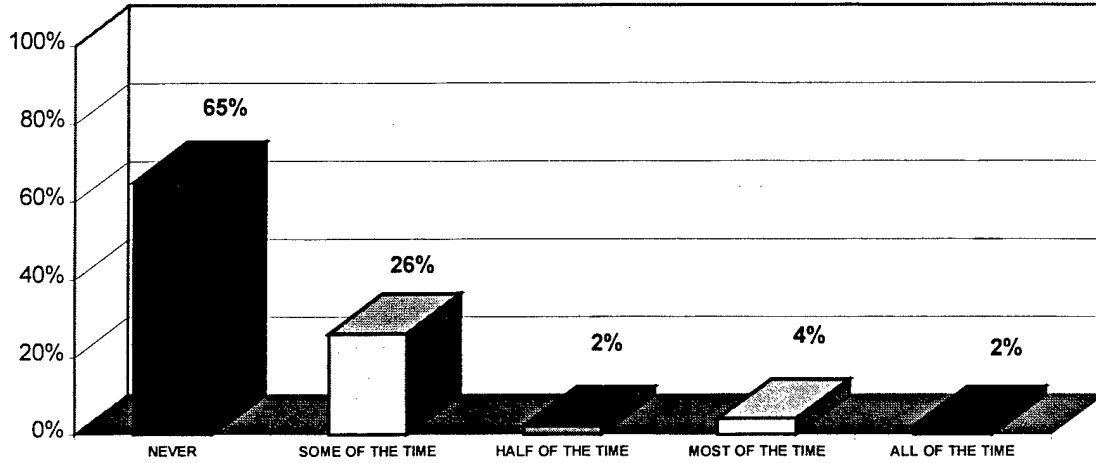




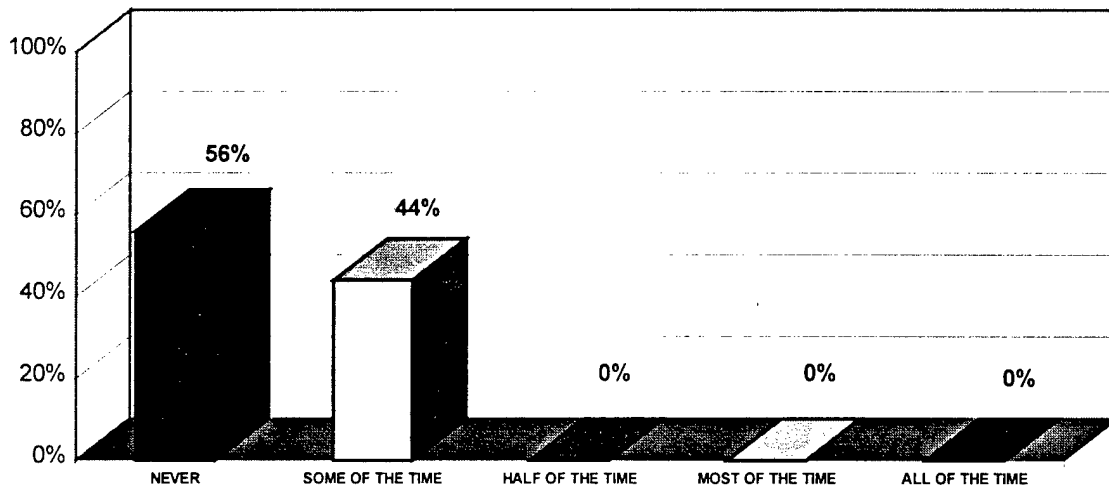
**CONNECTING AND DISCONNECTING COMPONENT CONNECTORS**



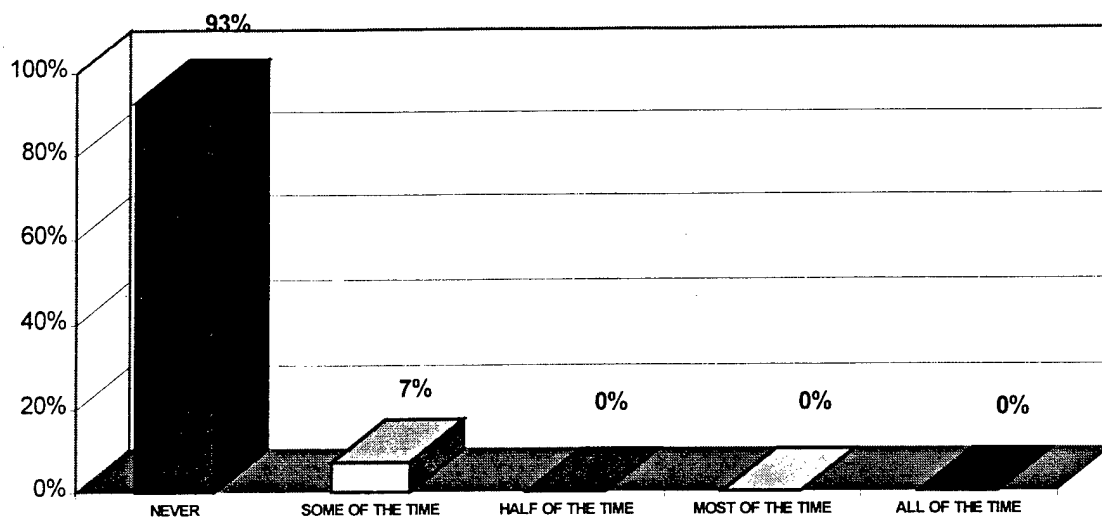
### 68X RESPONSES



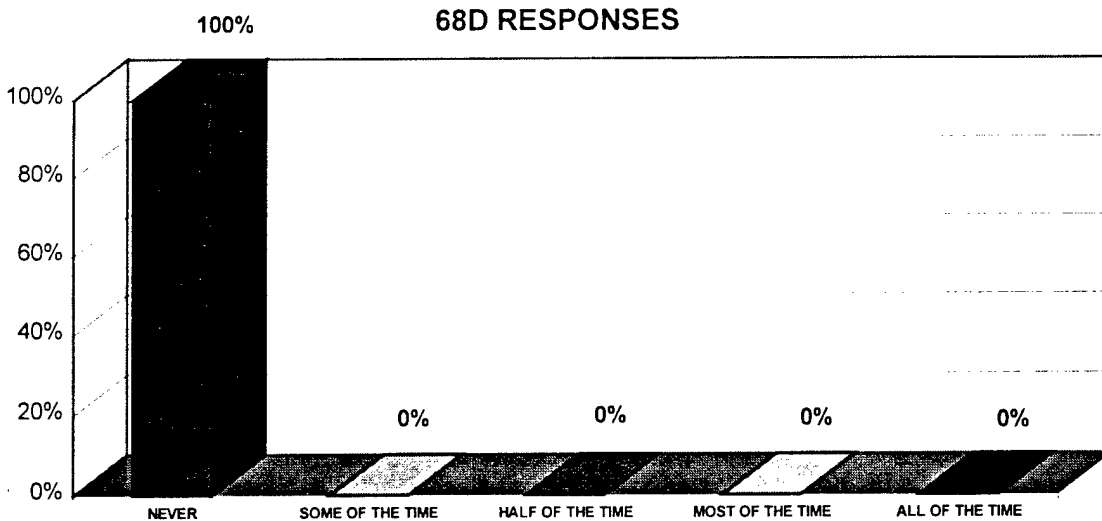
### 68N RESPONSES



### 68B RESPONSES

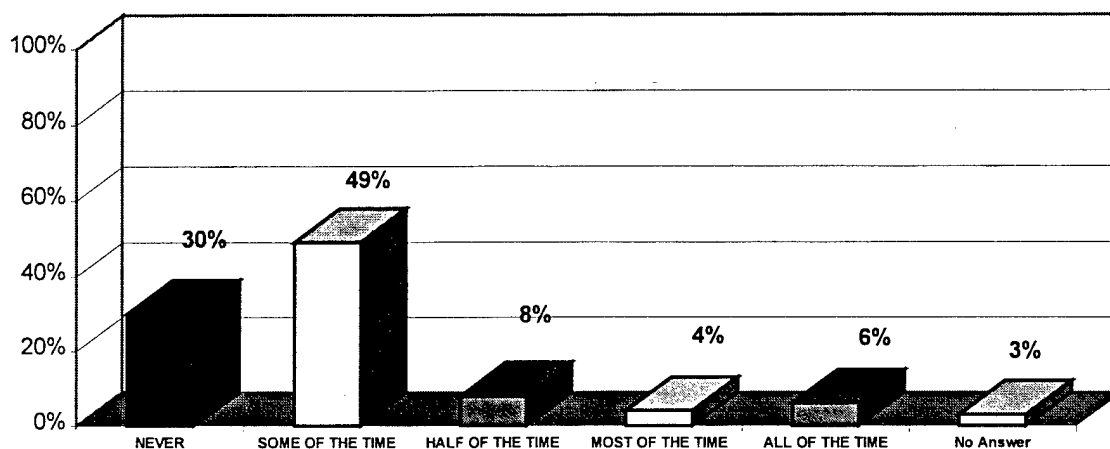


### 68D RESPONSES

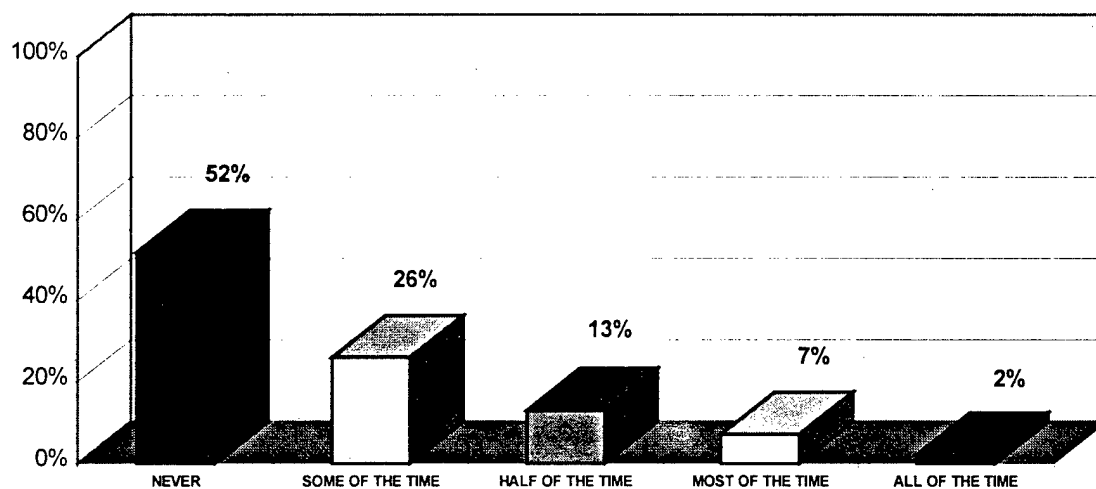


## LIFTING AND CARRYING AIRCRAFT COMPONENTS

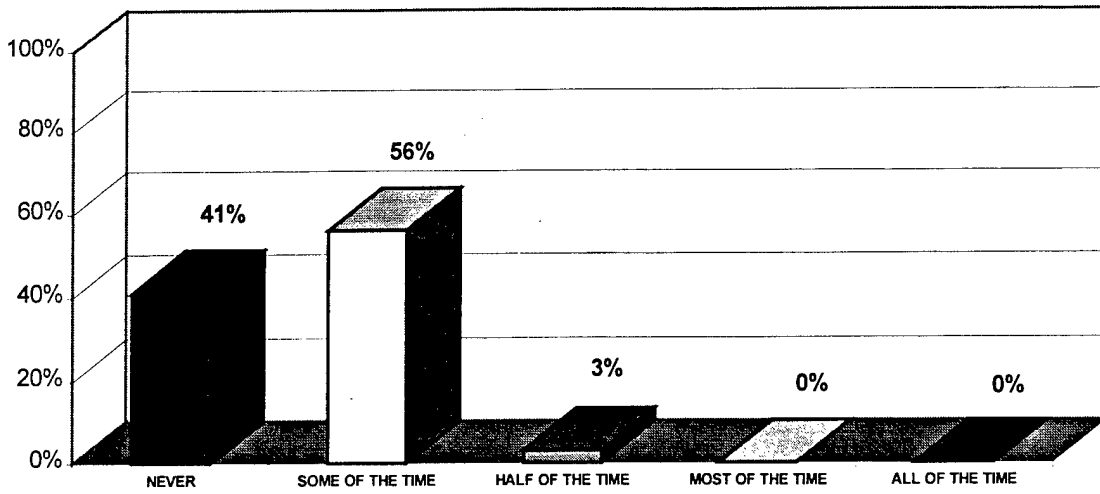
67R RESPONSES



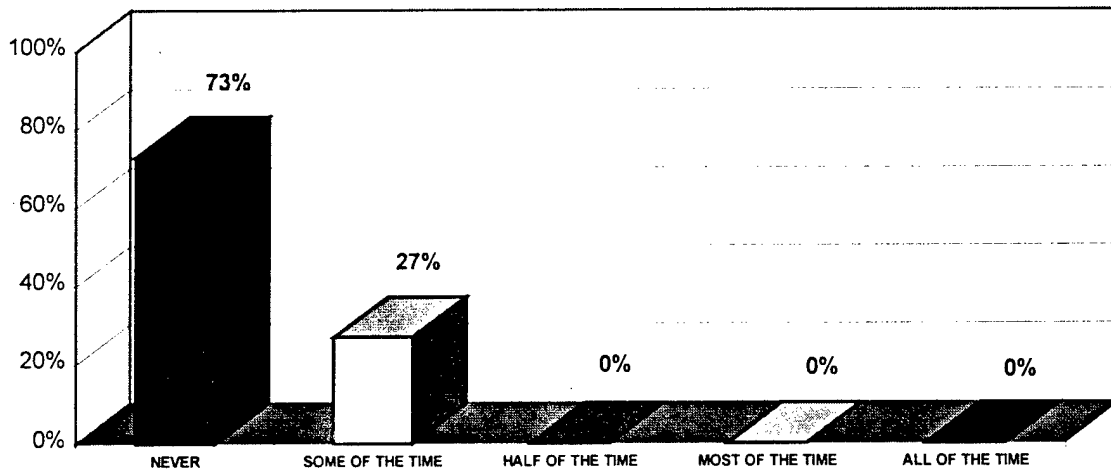
68X RESPONSES



**68N RESPONSES**

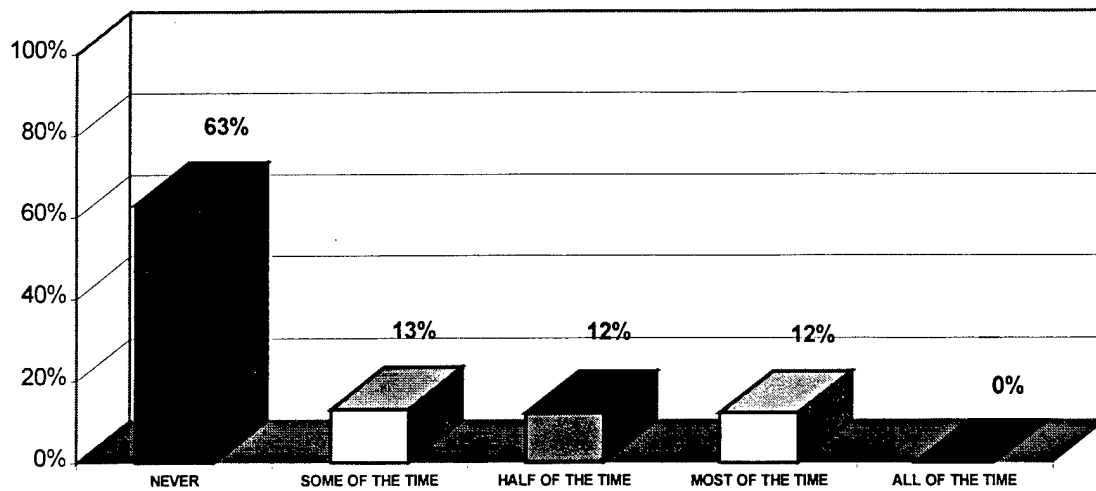


**68B RESPONSES**



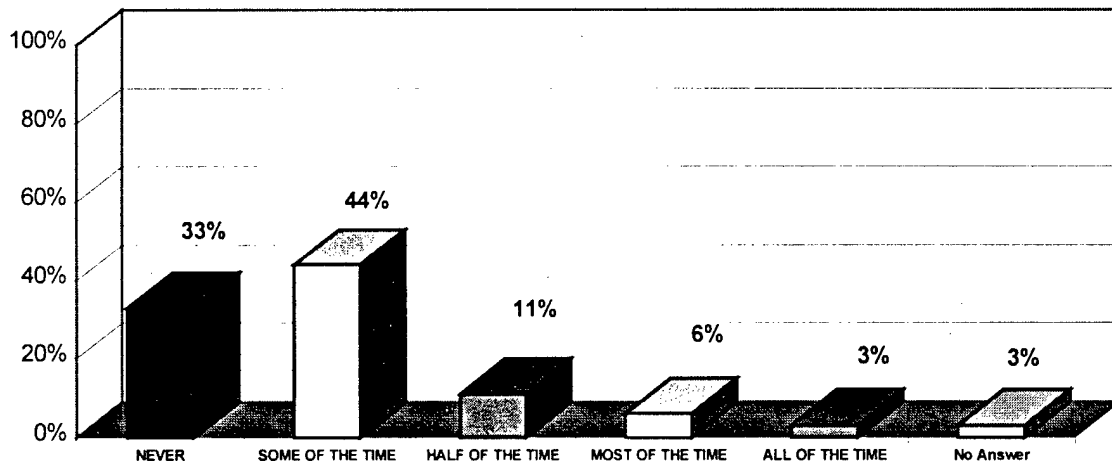


### 68D RESPONSES

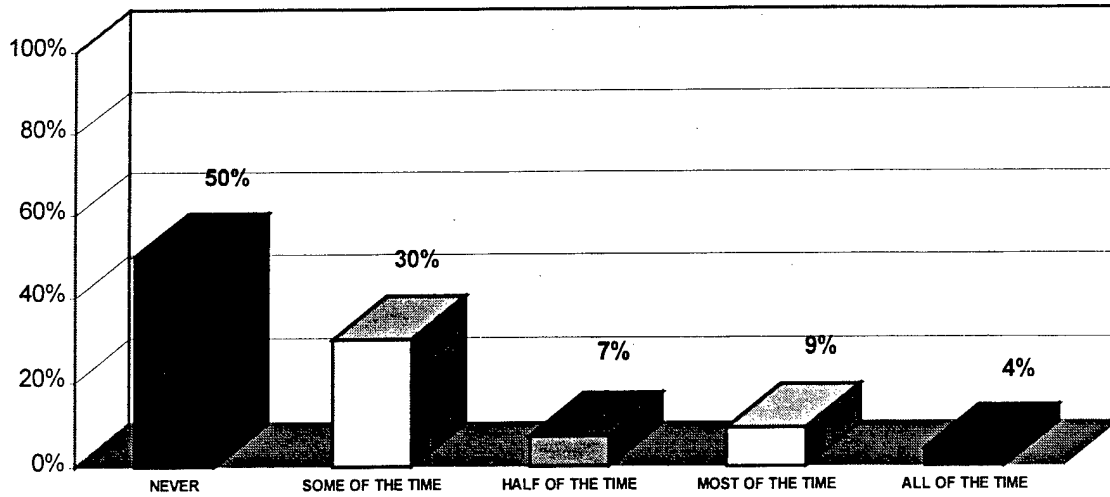


### REMOVAL AND REPLACEMENT OF AIRCRAFT COMPONENTS

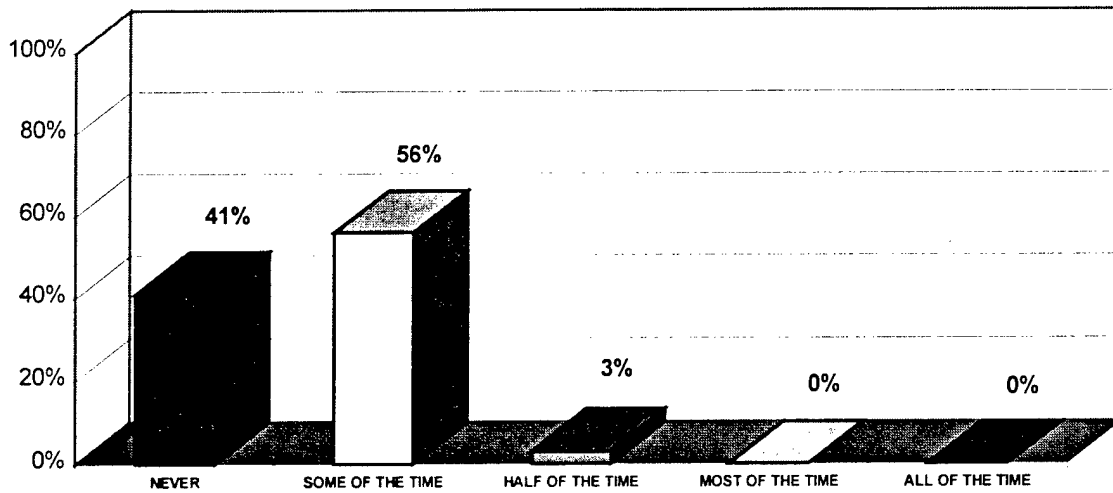
### 67R RESPONSES



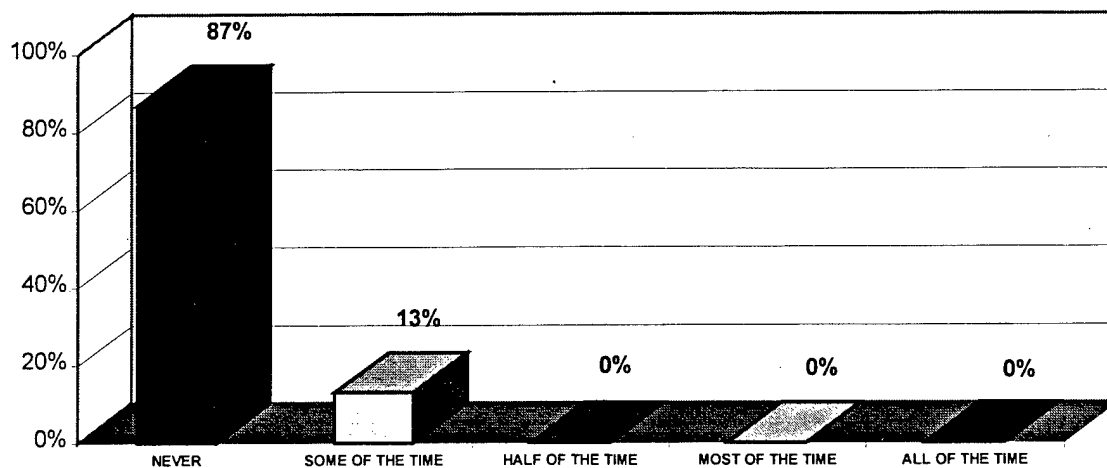
### 68X RESPONSES



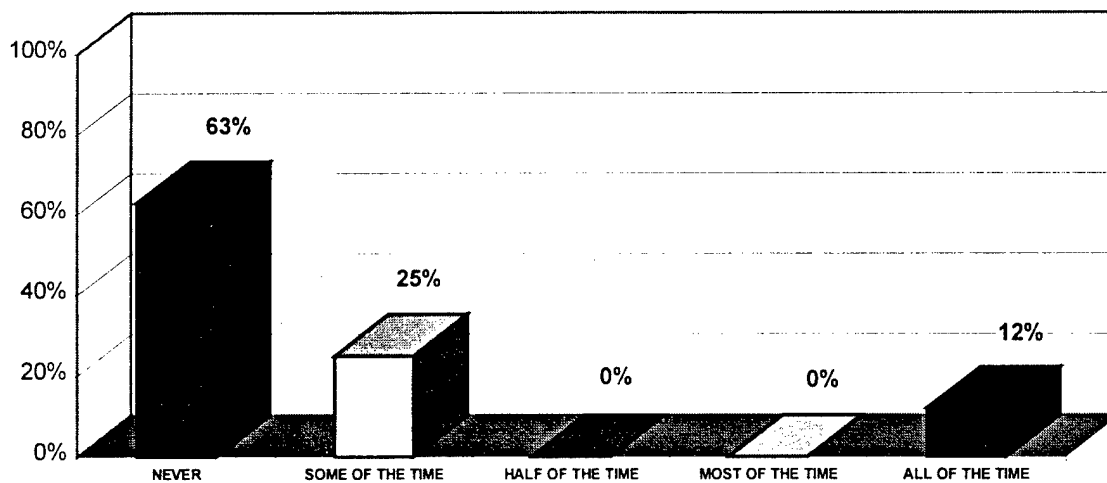
### 68N RESPONSES



### 68B RESPONSES

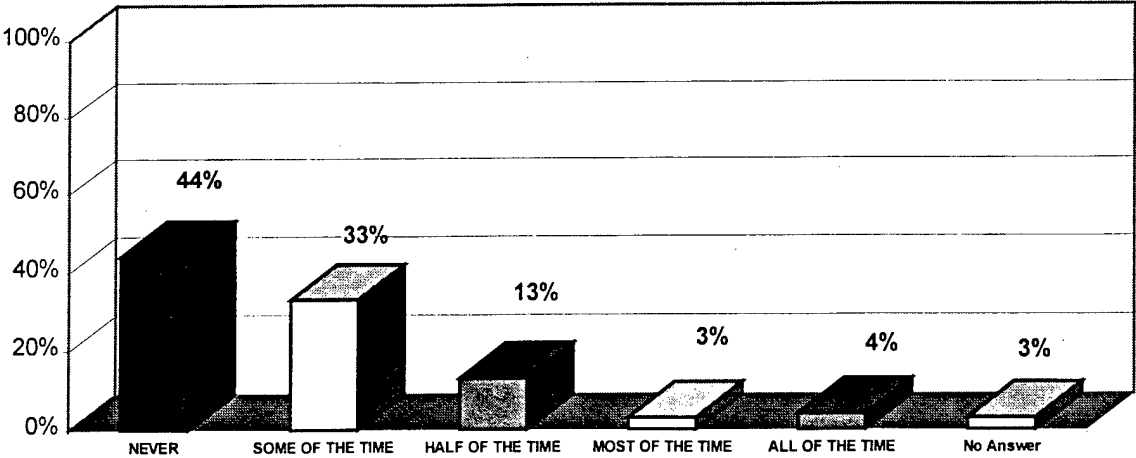


### 68D RESPONSES

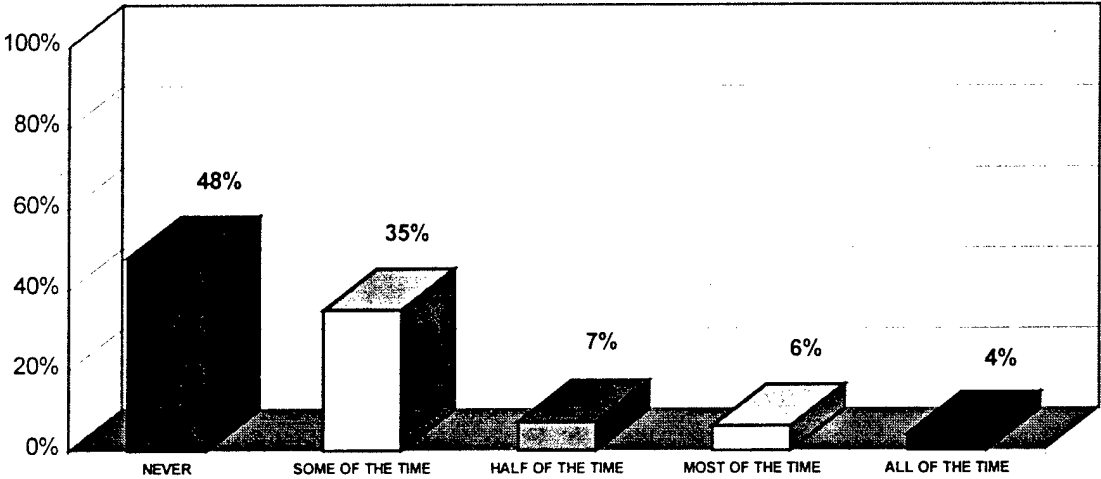


**PERFORMING OPERATIONAL CHECKS ON AIRCRAFT COMPONENTS**

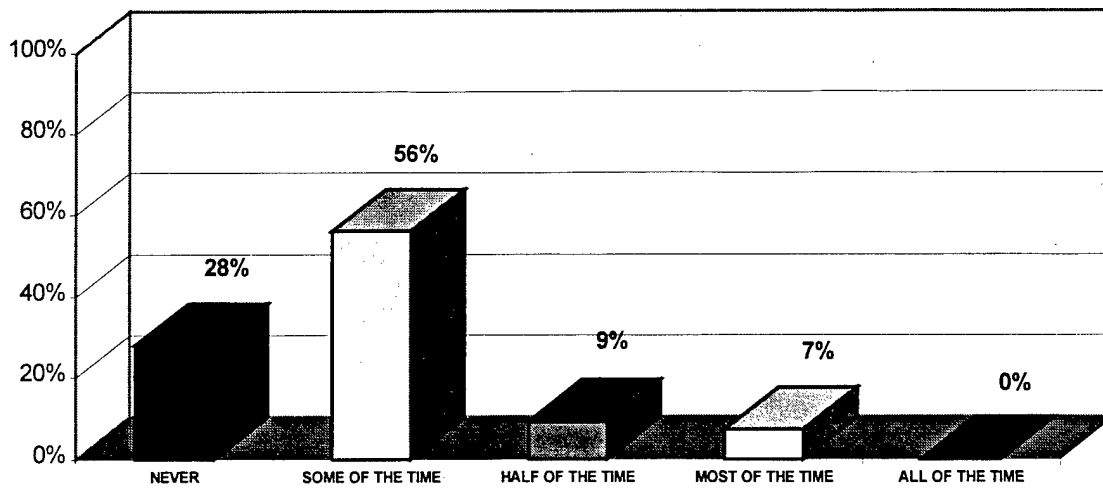
**67R RESPONSES**



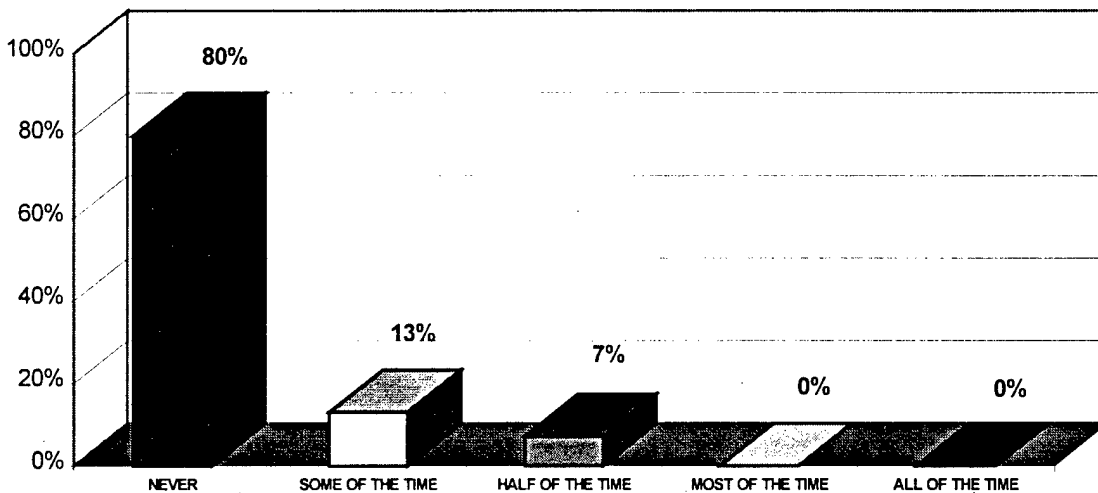
**68X RESPONSES**



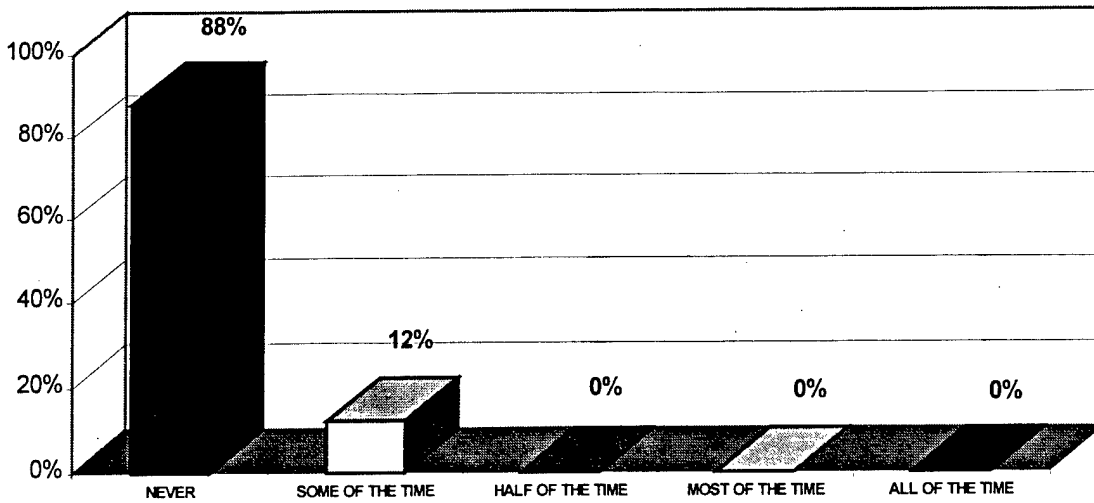
### 68N RESPONSES



### 68B RESPONSES

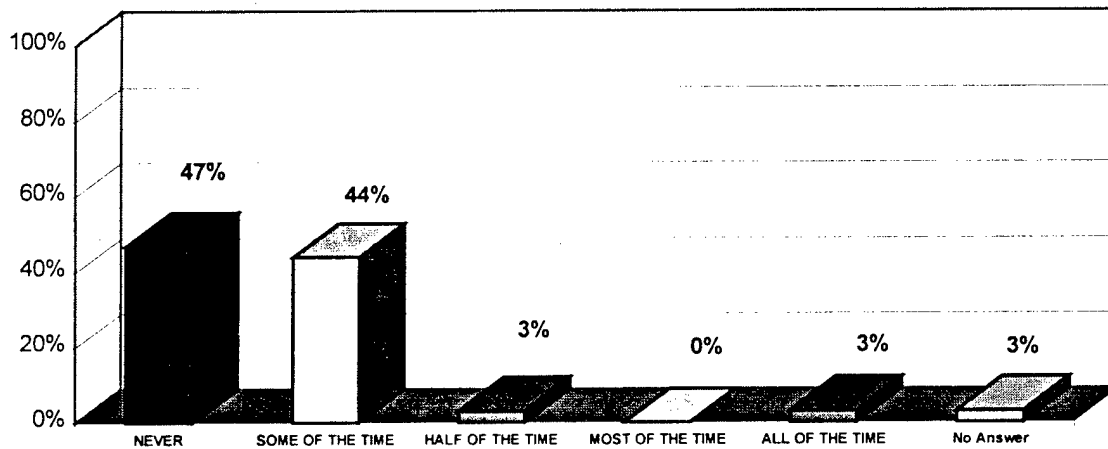


### 68D RESPONSES

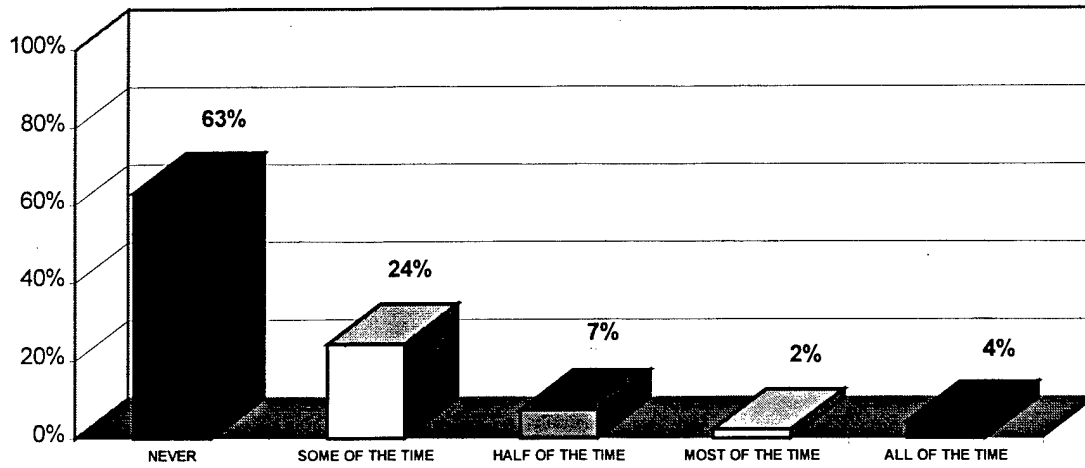


### INSPECTING AIRCRAFT COMPONENTS

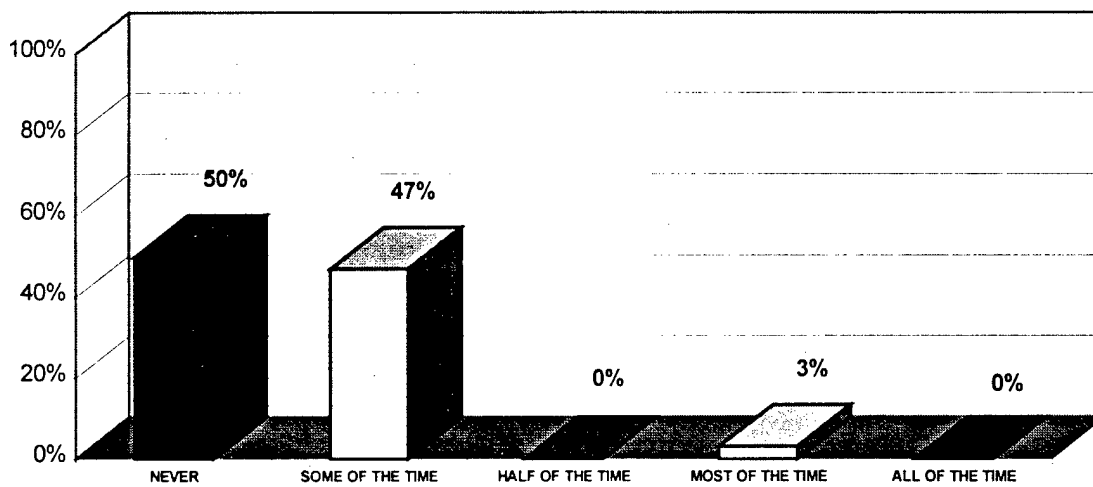
### 67R RESPONSES



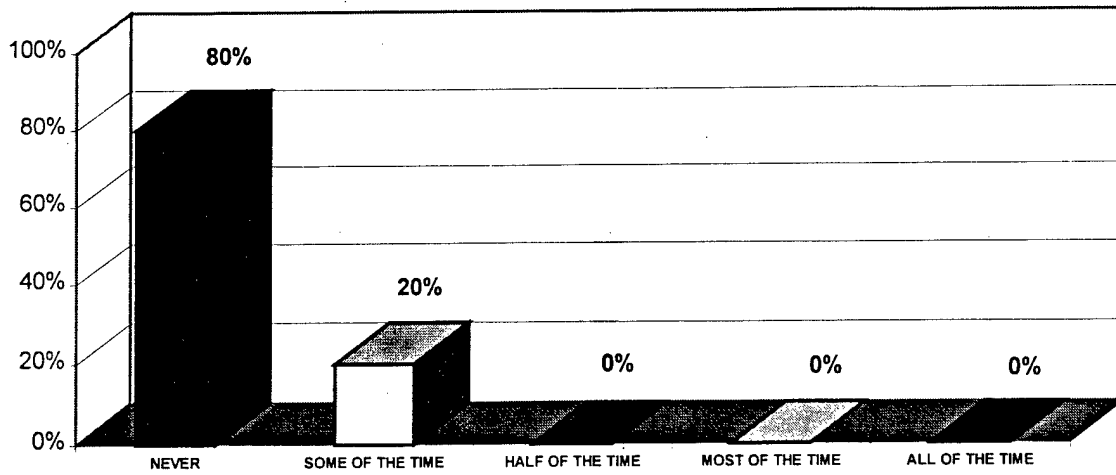
### 68X RESPONSES



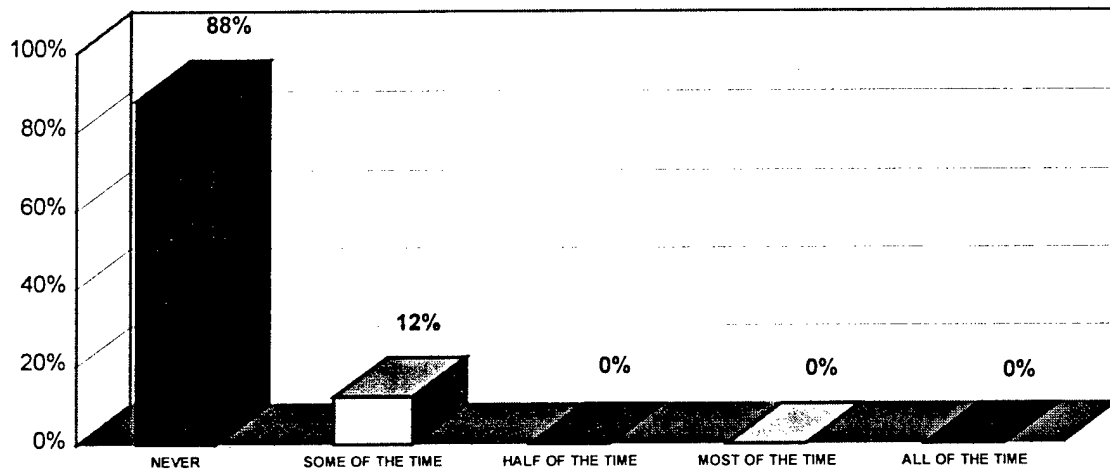
### 68N RESPONSES



**68B RESPONSES**



**68D RESPONSES**





### **67R Comments**

No significant comments.

### **68X Comments**

No significant comments.

### **68N Comments**

#### **During operational checks and troubleshooting. (14 Comments)**

Two 68N's for commo checks. (1)

ALQ-136 MOC. (1)

APR-39 MOC. (1)

At least 2 personnel during troubleshooting for safety reasons when operating the APU and wire troubleshooting. (1)

Need a 68N and 68F for working on electrical problems. (1)

Need a 68N and 68F for working on the Doppler-HARS interface. (1)

Need a 68N and 68F for doing a VCR check. (1)

Need one pilot for aircraft power. (1)

Need a 68N and 68F for working on airspeed components. (1)

Need two personnel for ADF MOC. (1)

Need two personnel for HARS MOC. (1)

Need two personnel for Doppler MOC. (1)

Need three personnel for HARS MOC - book calls for one. (1)

Need three personnel for Doppler MOC - book calls for one. (1)

One extra 68N to assist in troubleshooting and operational checks. 67Rs are not trained to assist with avionics. (1)

#### **Assist in remove, replace, and carry. (5 Comments)**

Removal of the ALQ-144. (1)

Removal of the ALQ-136 (2 personnel - 68N's). (1)

R&R of the APR-39. (1)

Carrying test equipment. (1)

Need three 68X's for removal of forward APR-39 receiver. (1)

### **68B Comments**

No significant comments.

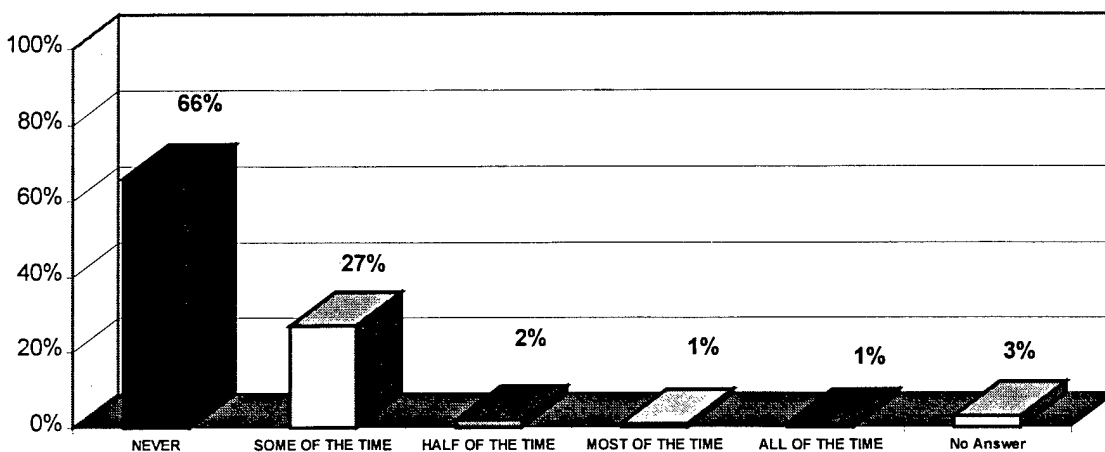
**68D Comments**

No significant comments.

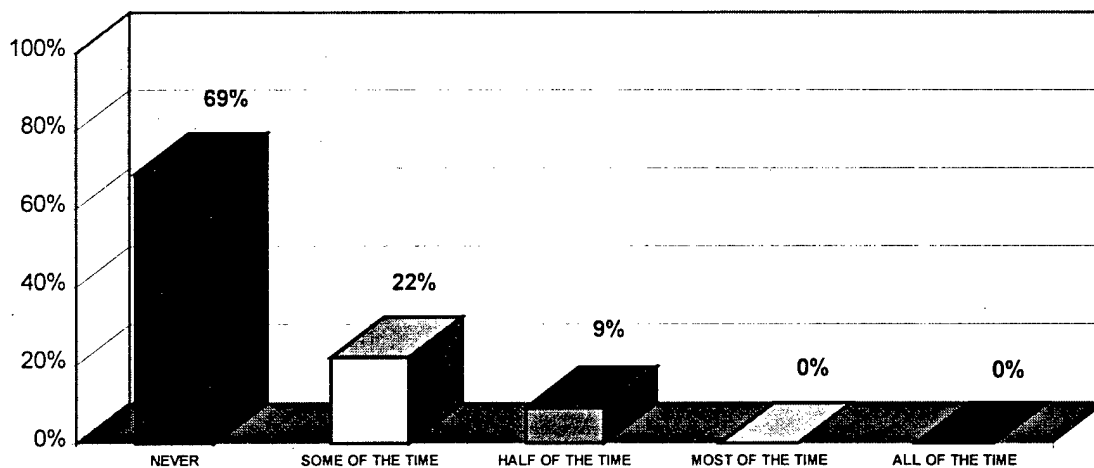
**MR2. How often do you need LESS personnel than specified in the Technical Manual to assist you in performing the following tasks?**

**TROUBLESHOOTING AIRCRAFT COMPONENTS:**

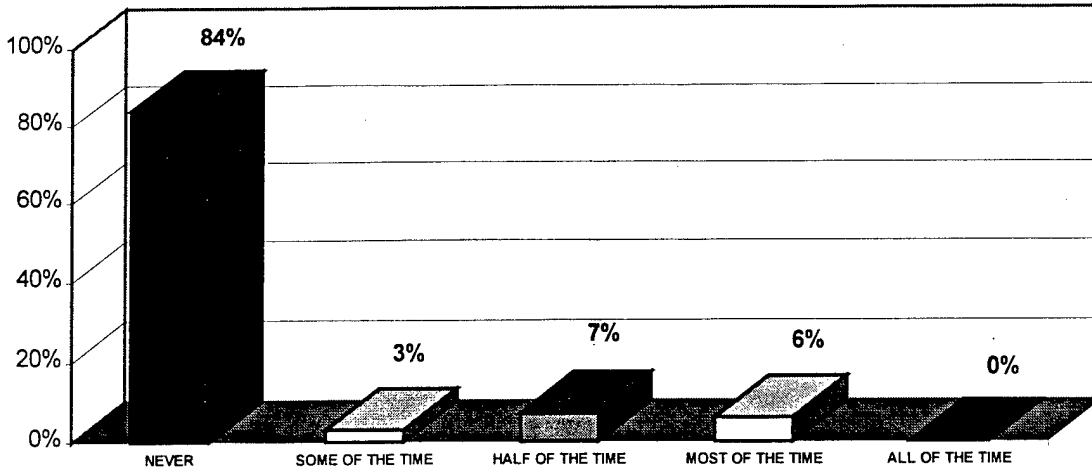
**67R RESPONSES**



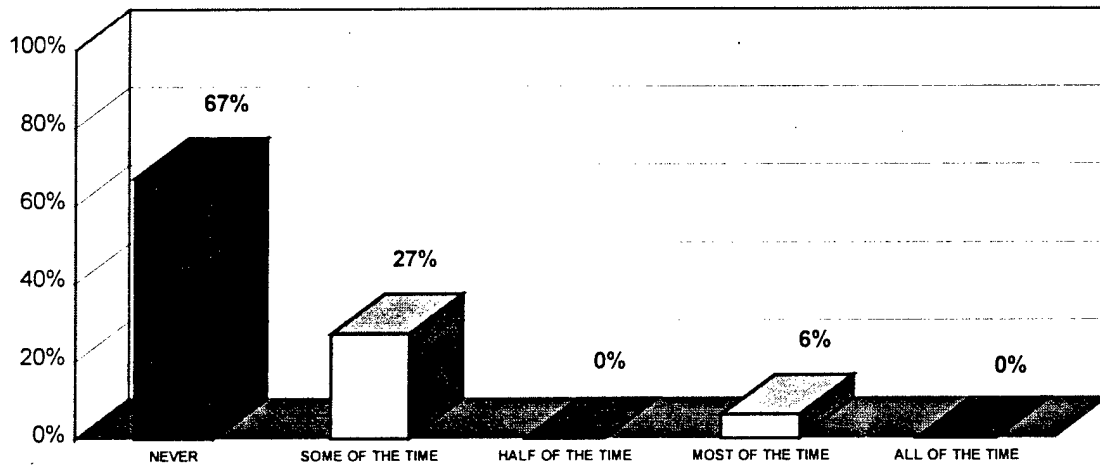
**68X RESPONSES**



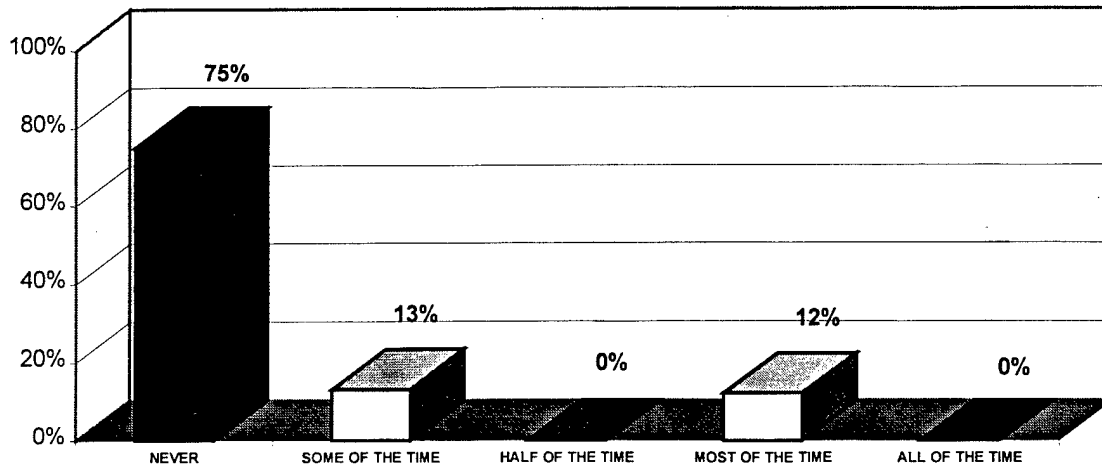
### 68N RESPONSES



### 68B RESPONSES

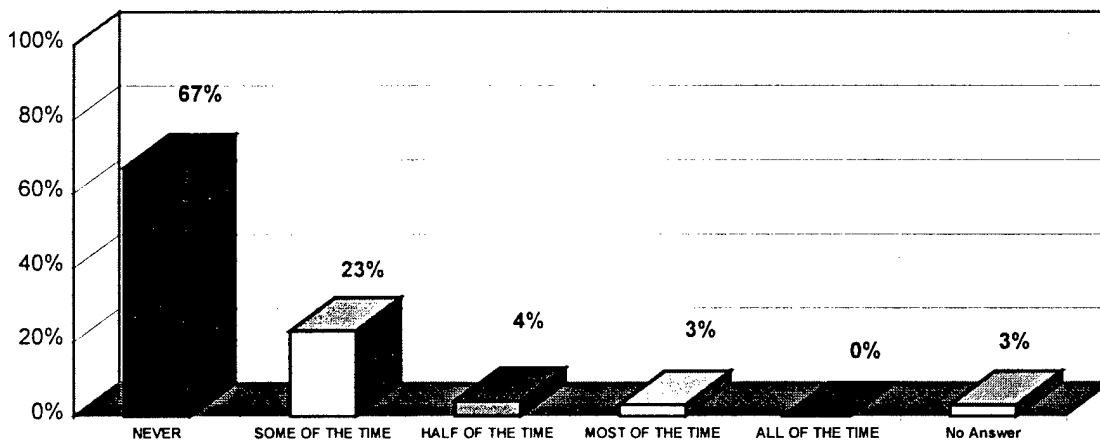


### 68D RESPONSES

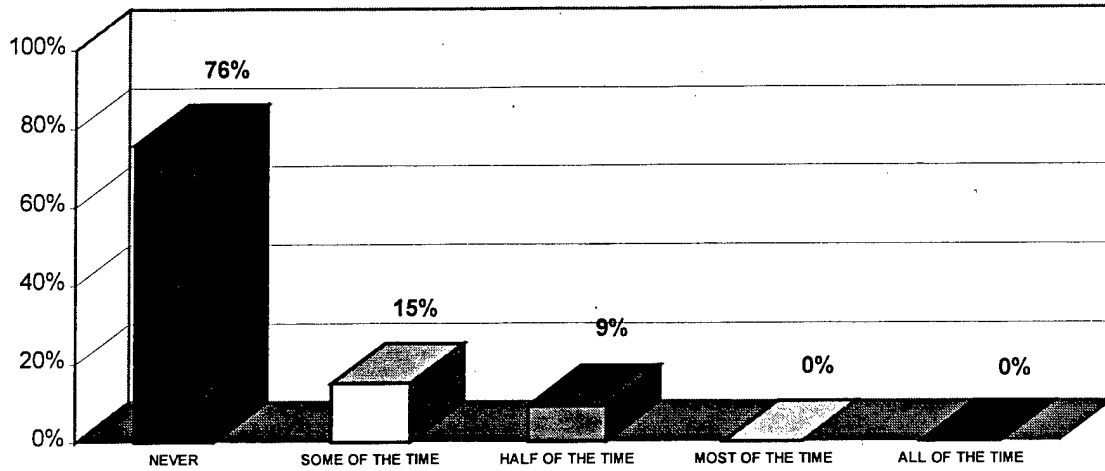


### ACCESSING AIRCRAFT COMPONENTS

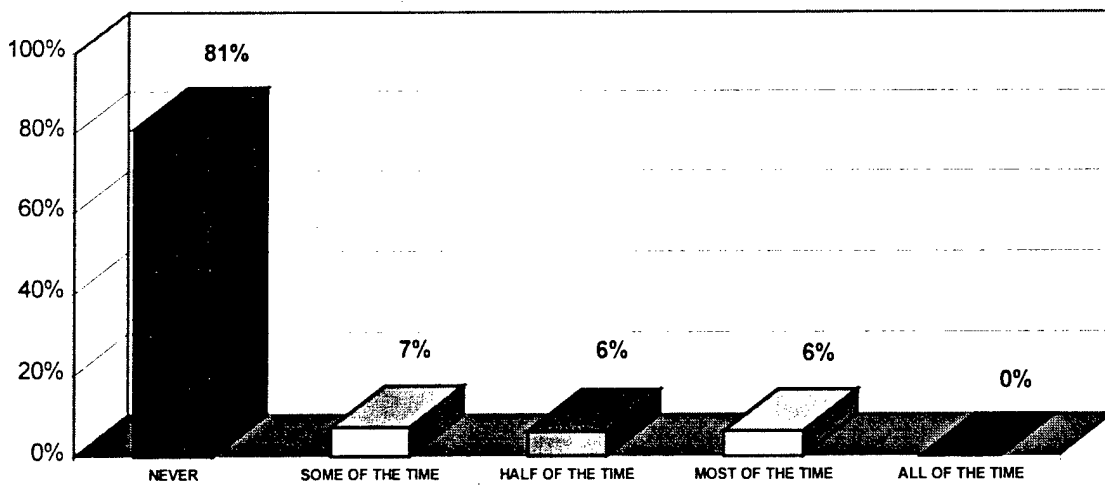
### 67R RESPONSES



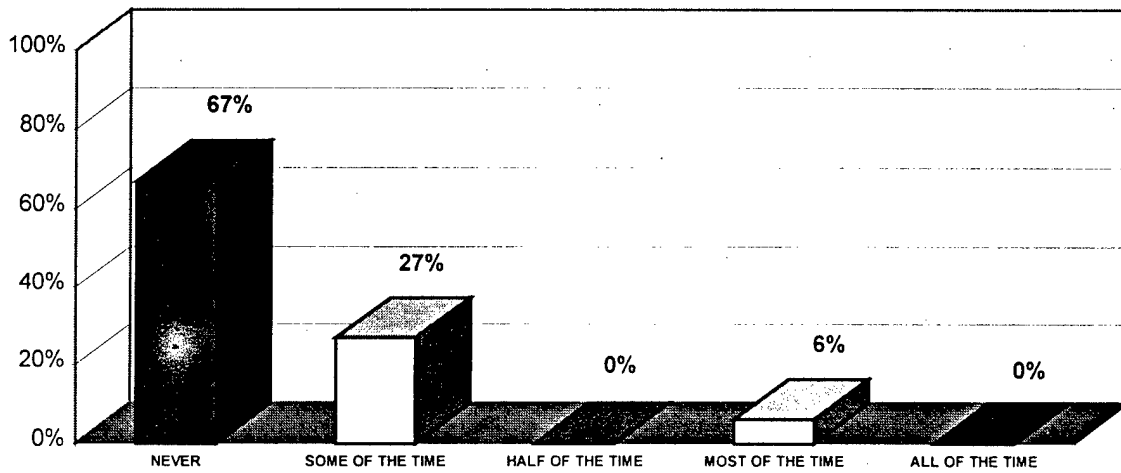
### 68X RESPONSES



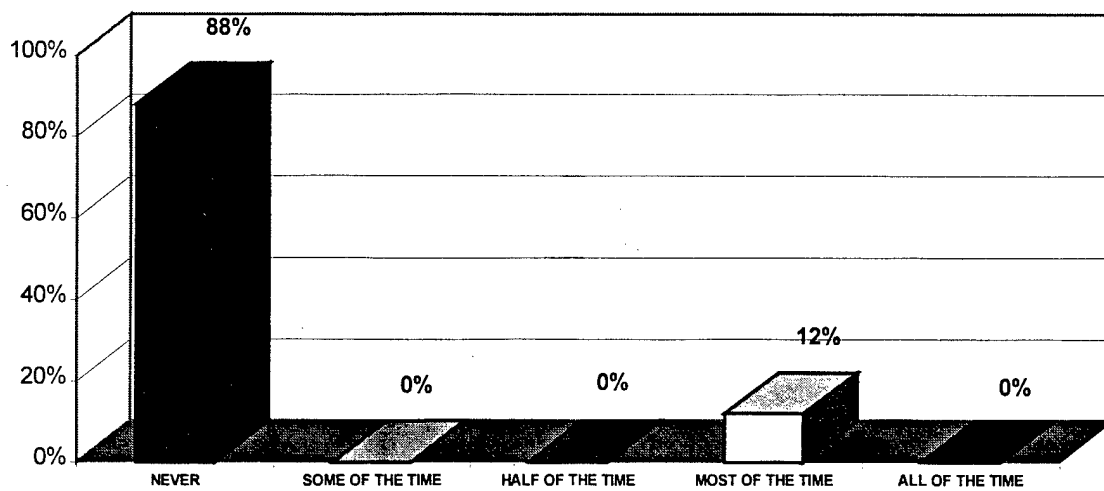
### 68N RESPONSES



### 68B RESPONSES

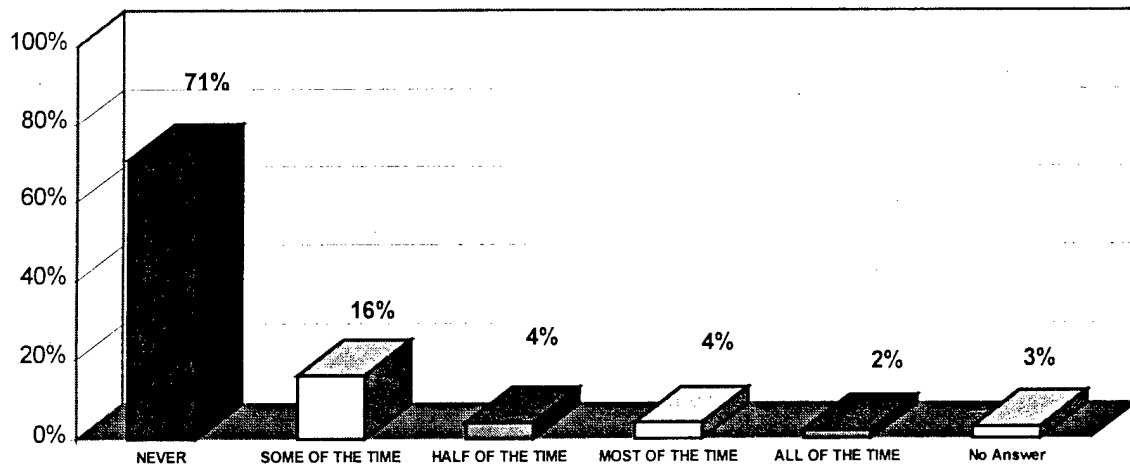


### 68D RESPONSES

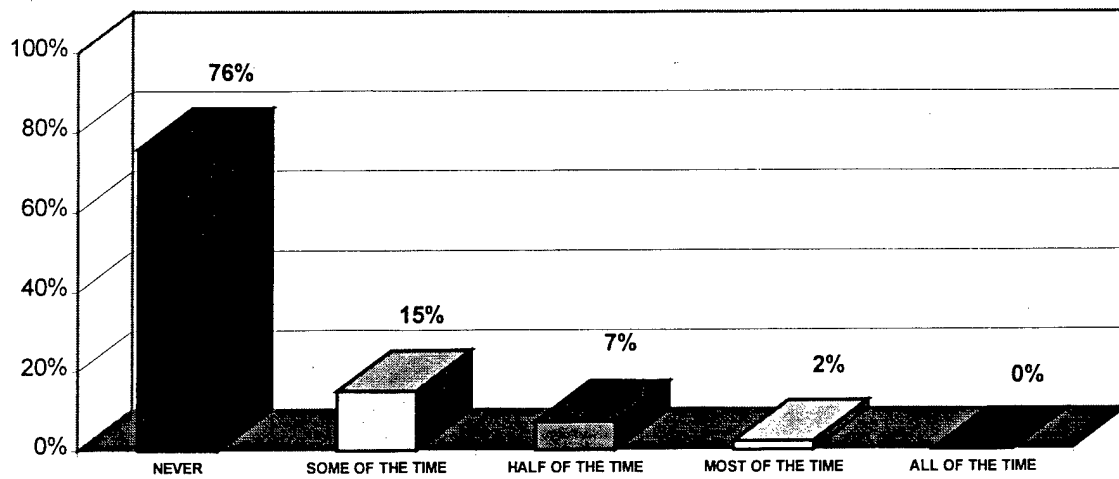


## FASTENING AND UNFASTENING COMPONENT CONNECTORS

67R RESPONSES

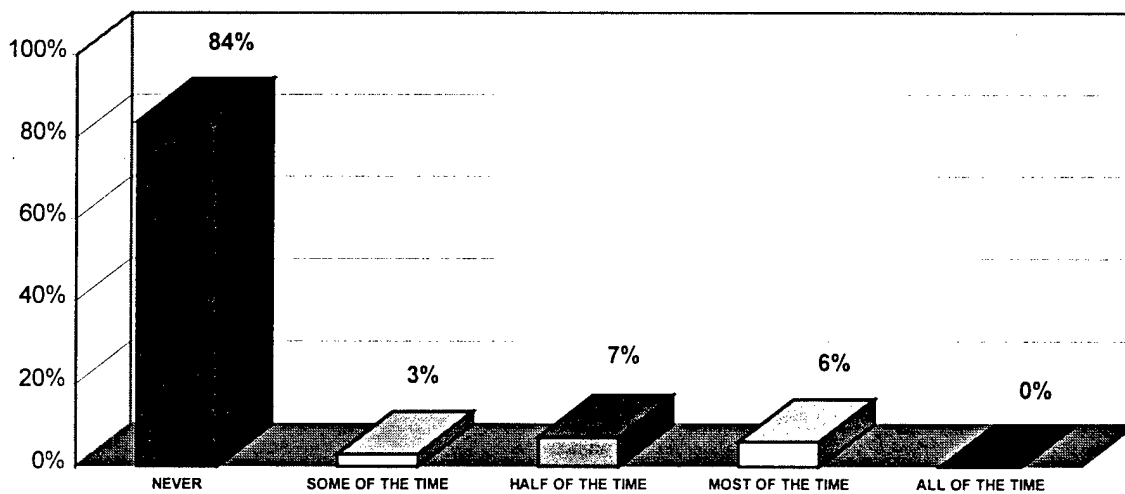


68X RESPONSES

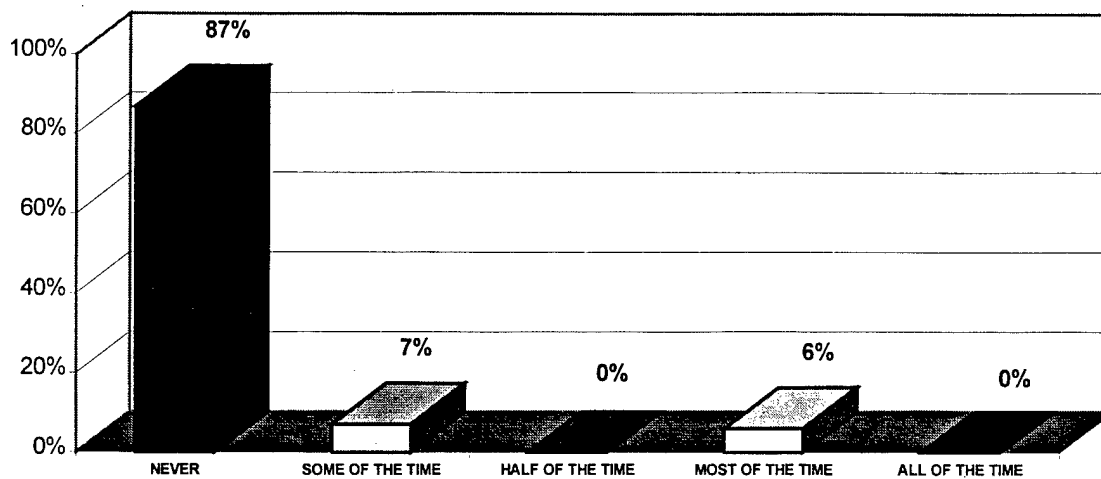




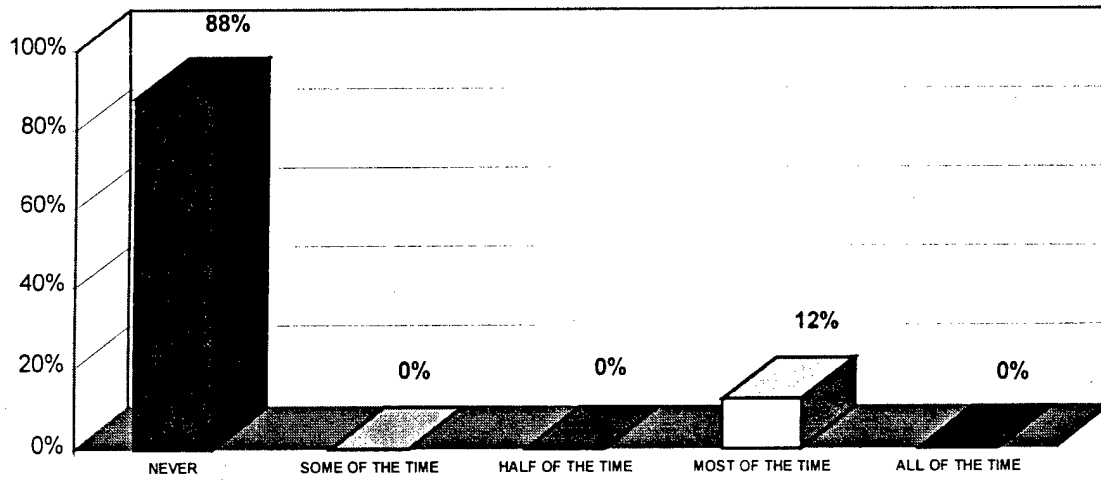
### 68N RESPONSES



### 68B RESPONSES

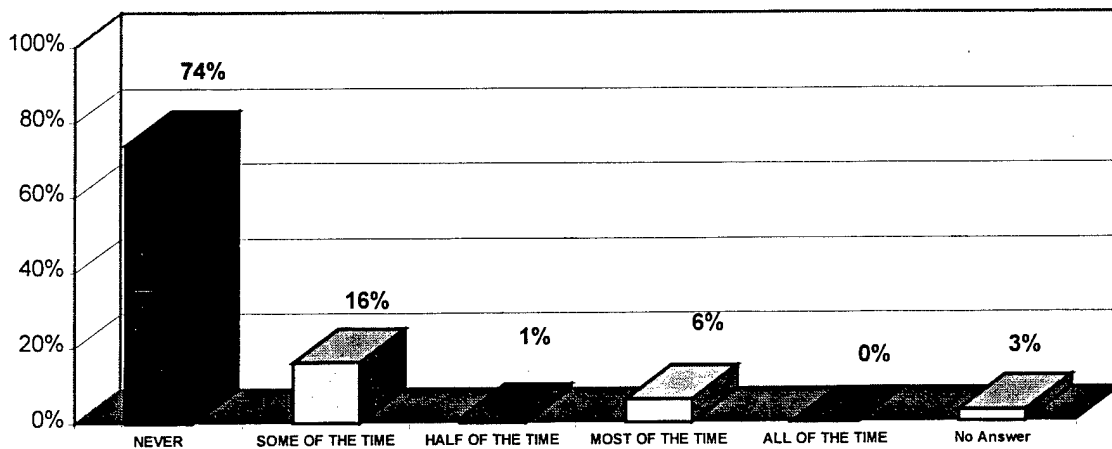


### 68D RESPONSES

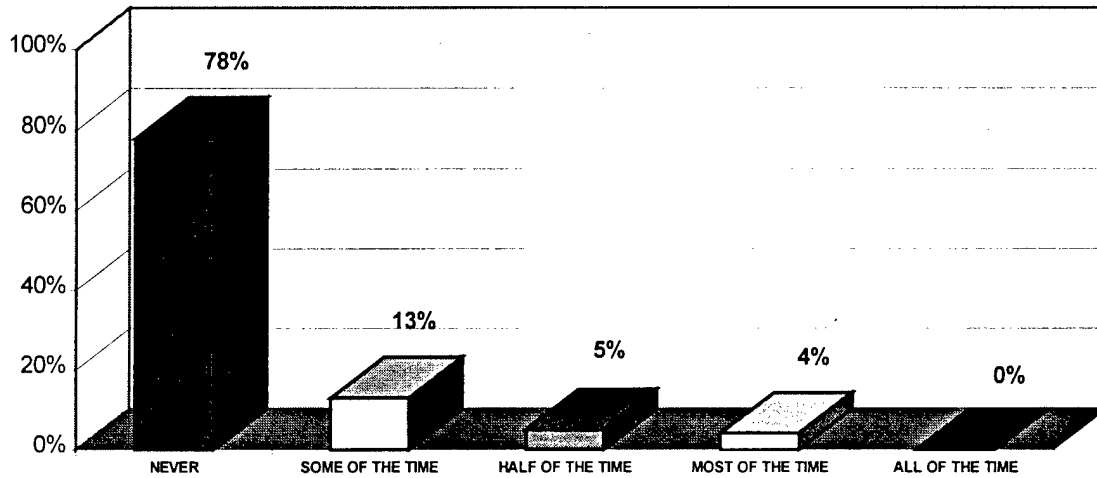


### CONNECTING AND DISCONNECTING COMPONENT CONNECTORS

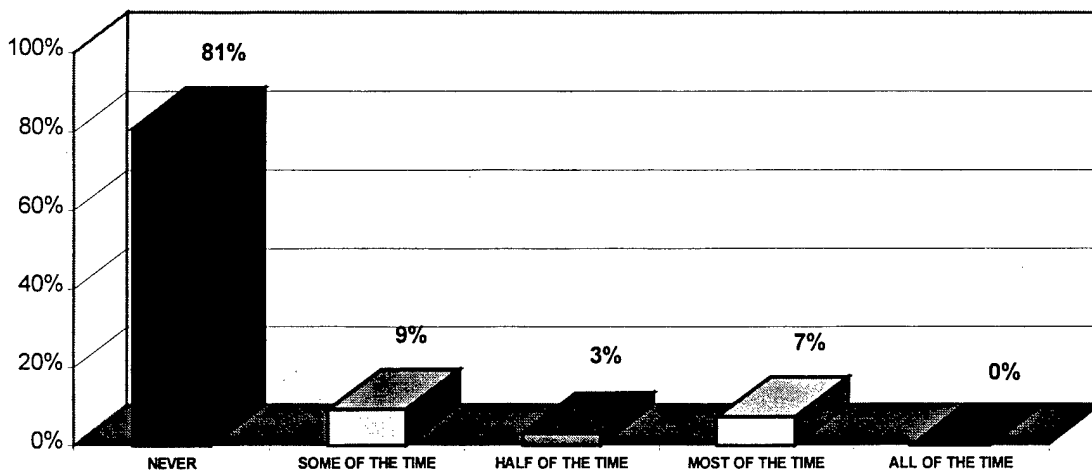
### 67R RESPONSES



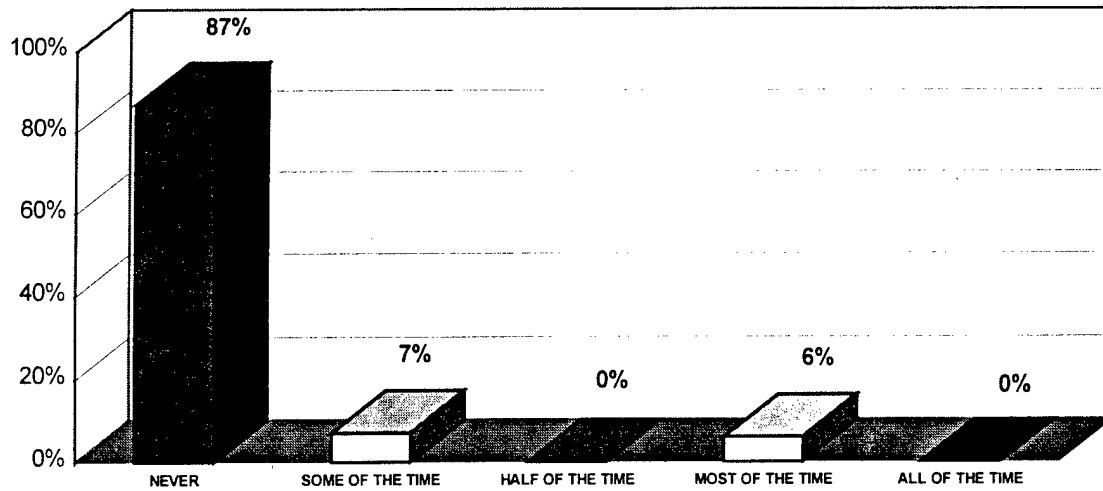
### 68X RESPONSES



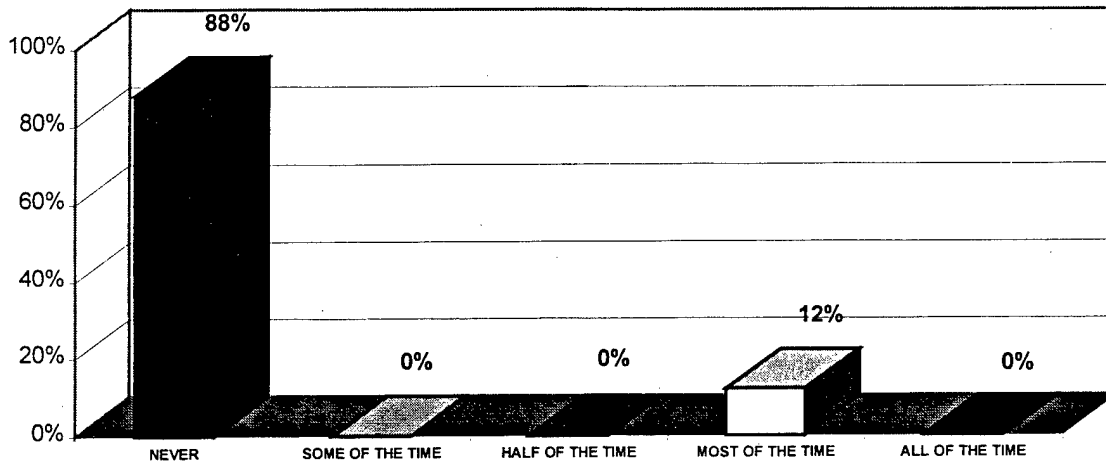
### 68N RESPONSES



### 68B RESPONSES

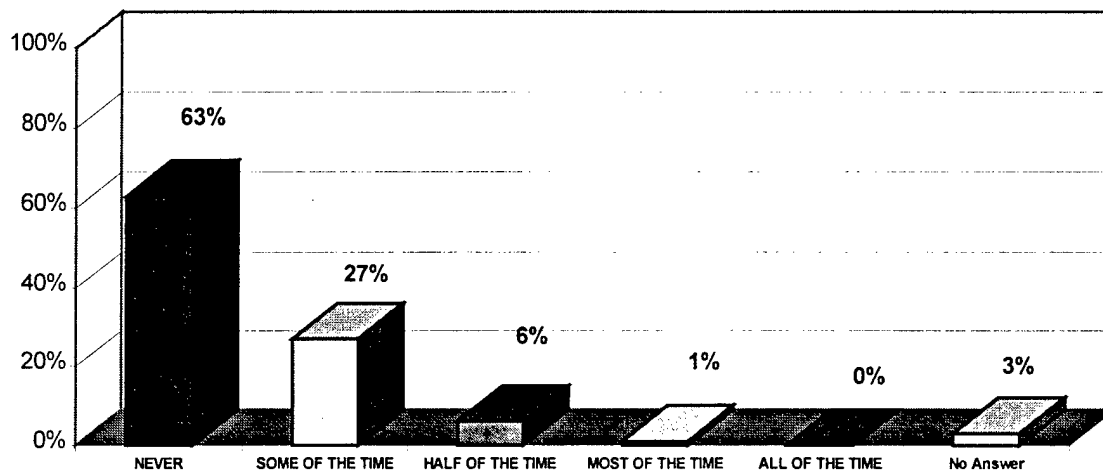


### 68D RESPONSES

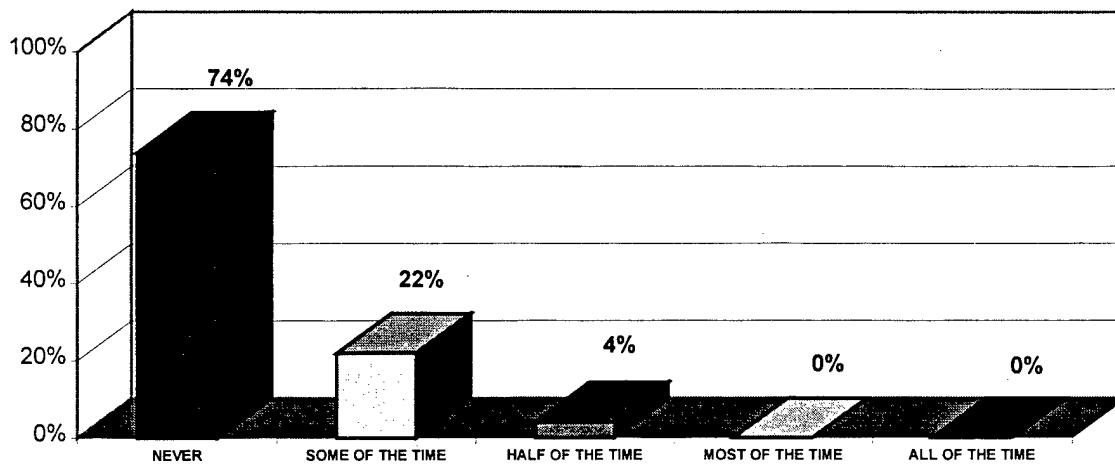


## LIFTING AND CARRYING AIRCRAFT COMPONENTS

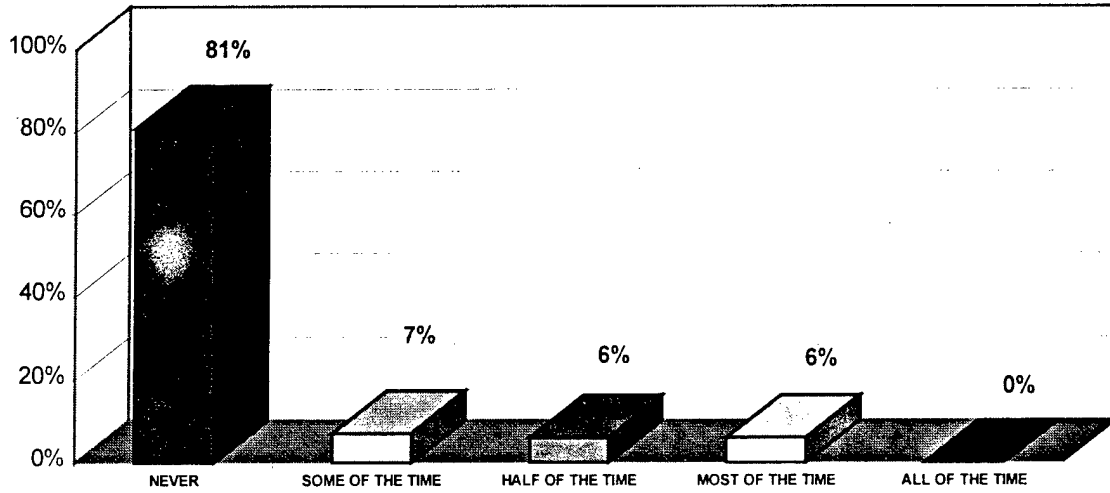
**67R RESPONSES**



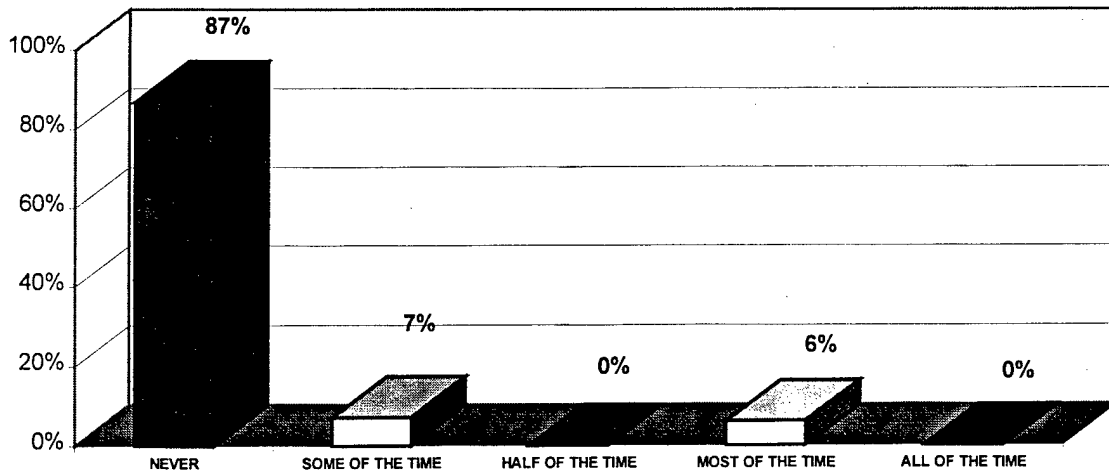
**68X RESPONSES**



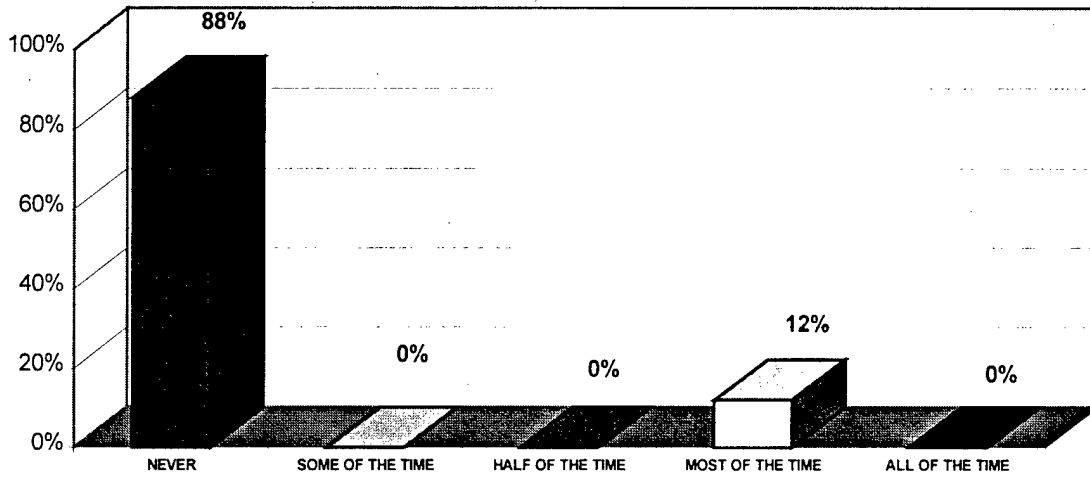
### 68N RESPONSES



### 68B RESPONSES

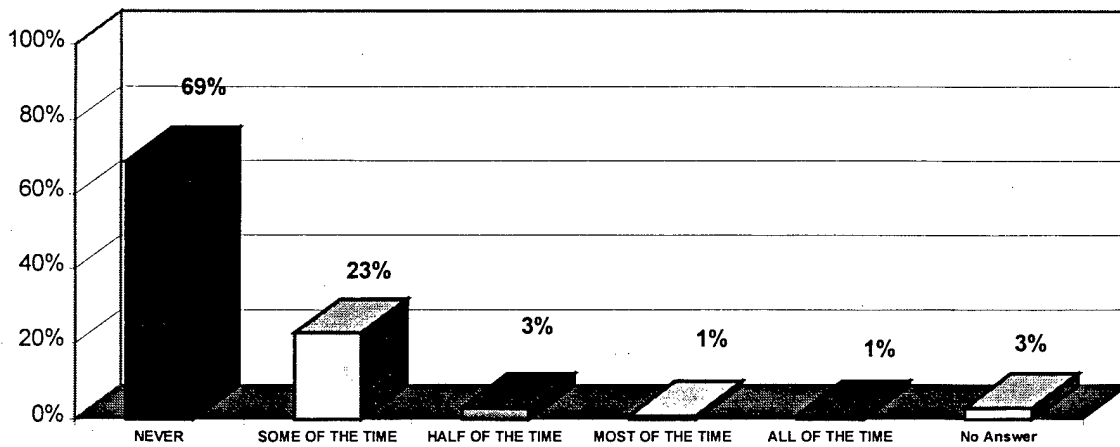


### 68D RESPONSES

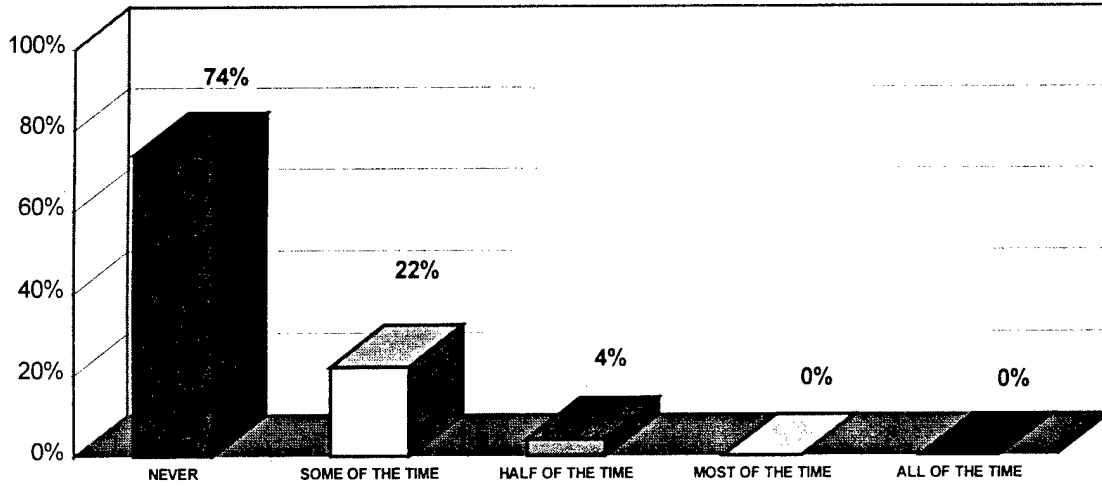


### REMOVING AND REPLACING AIRCRAFT COMPONENTS

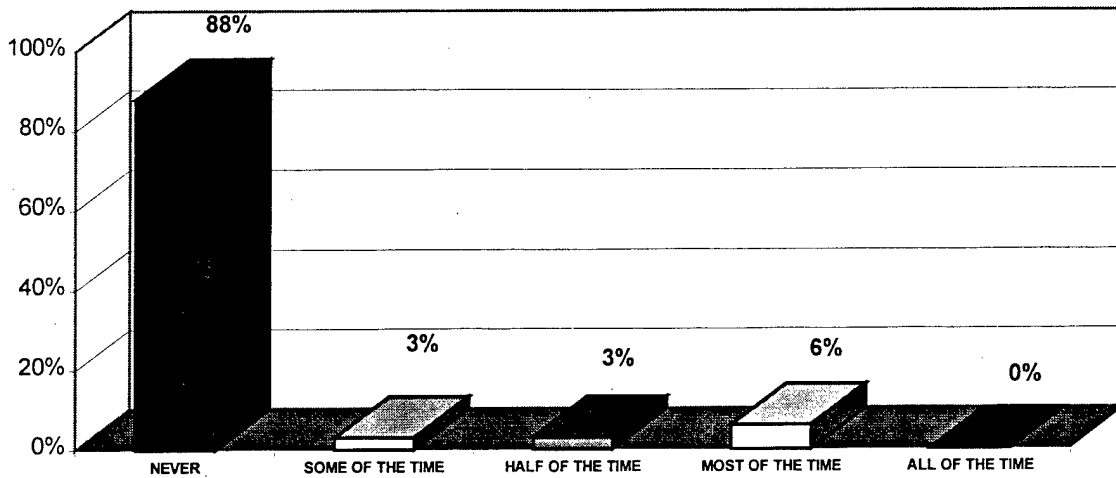
### 67R RESPONSES



### 68X RESPONSES

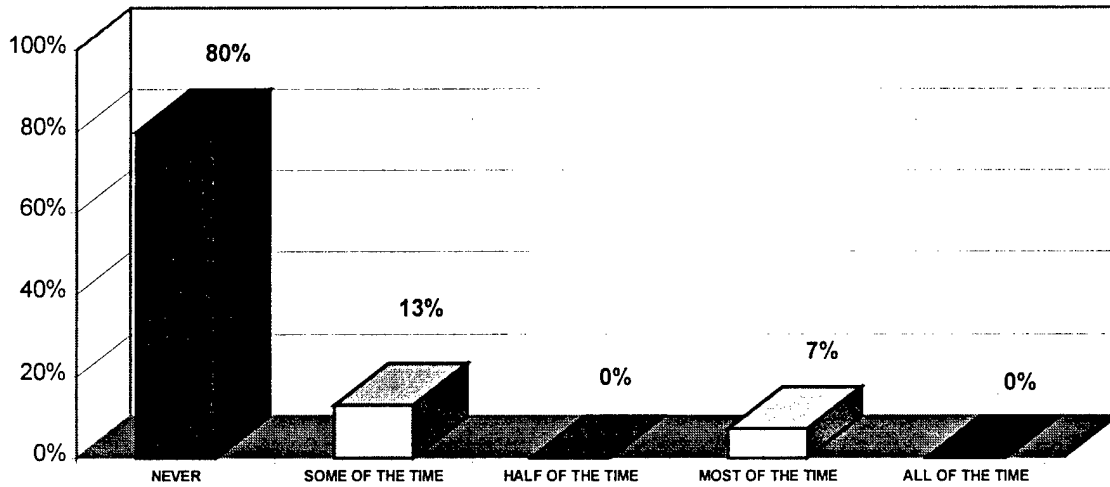


### 68N RESPONSES

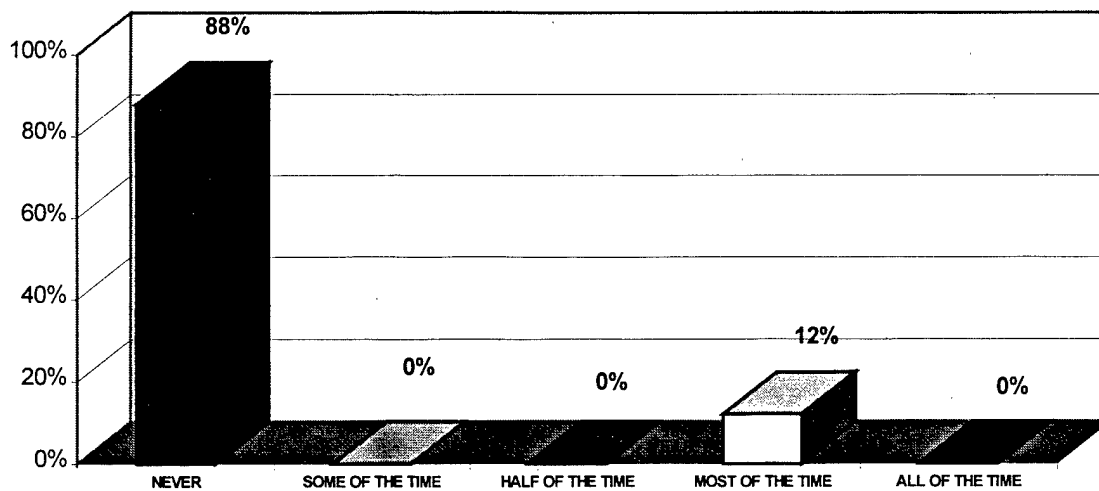




### 68B RESPONSES

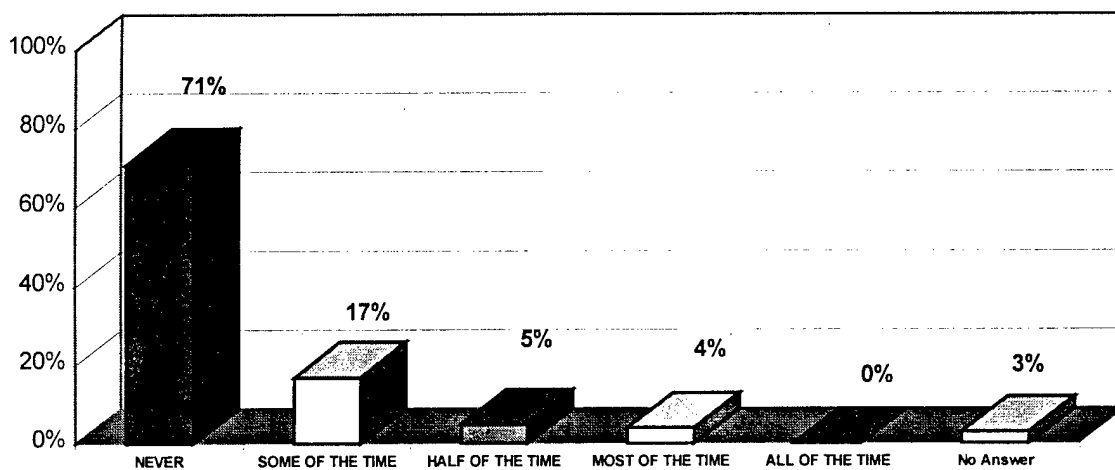


### 68D RESPONSES

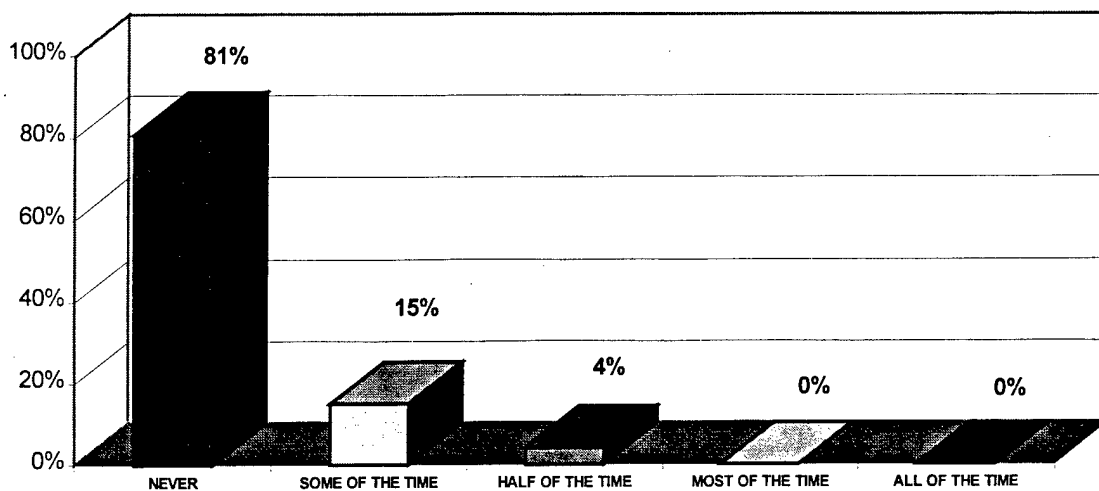


## PERFORMING OPERATIONAL CHECKS ON AIRCRAFT COMPONENTS

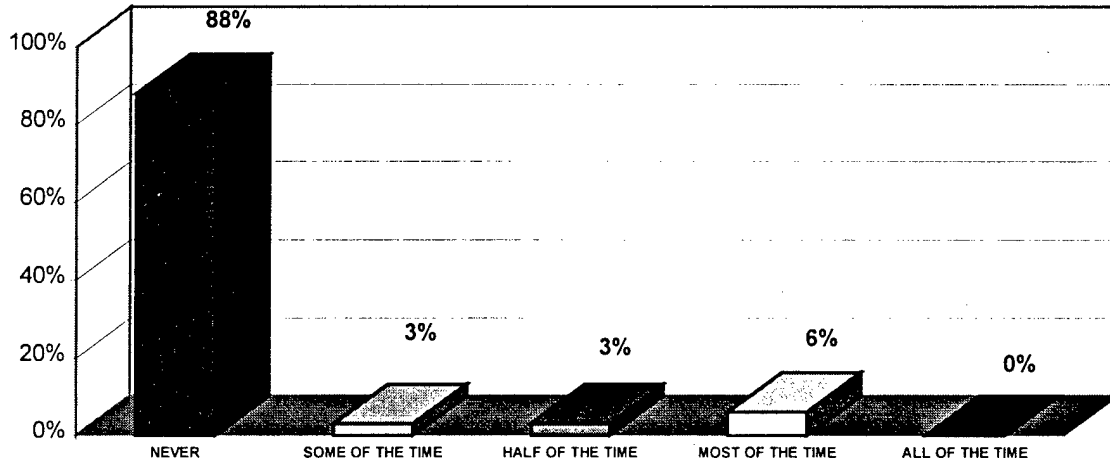
**67R RESPONSES**



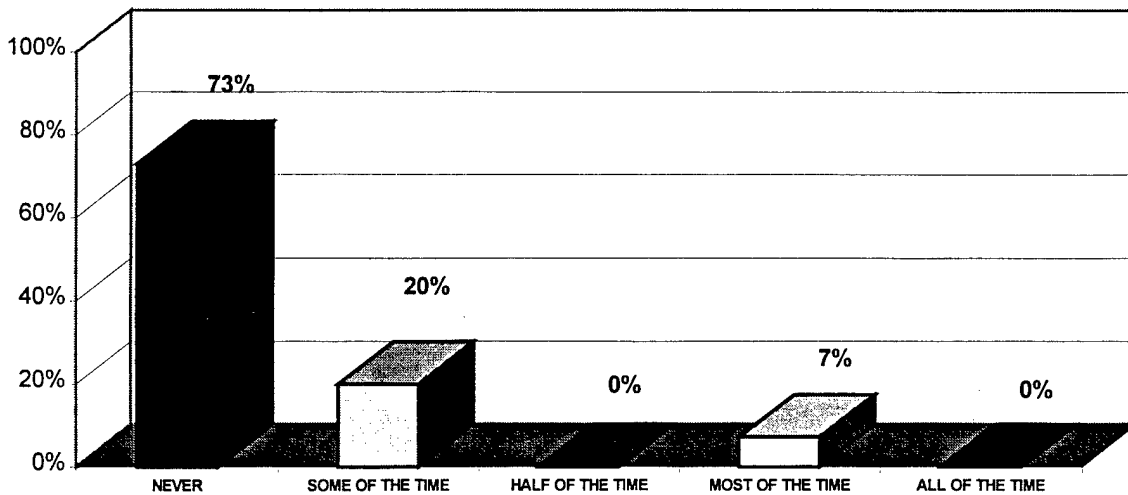
**68X RESPONSES**



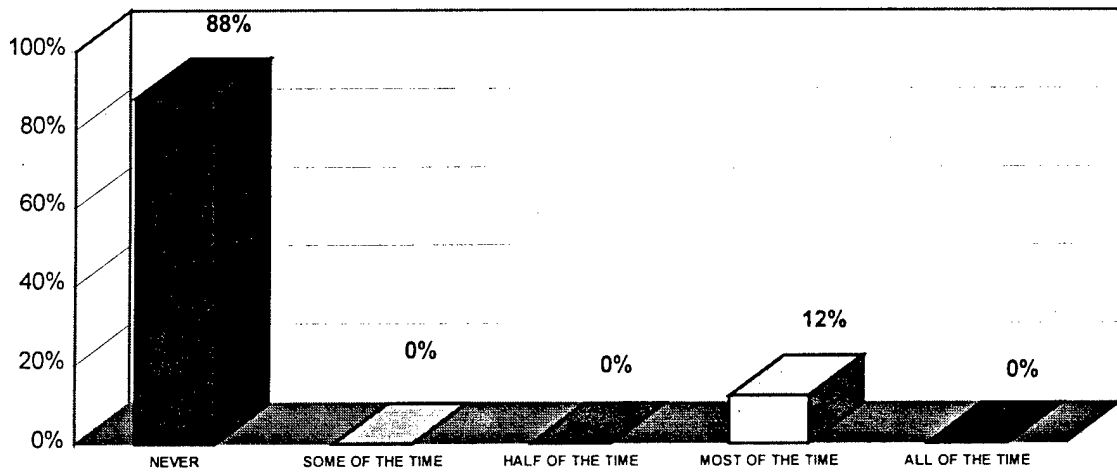
### 68N RESPONSES



### 68B RESPONSES

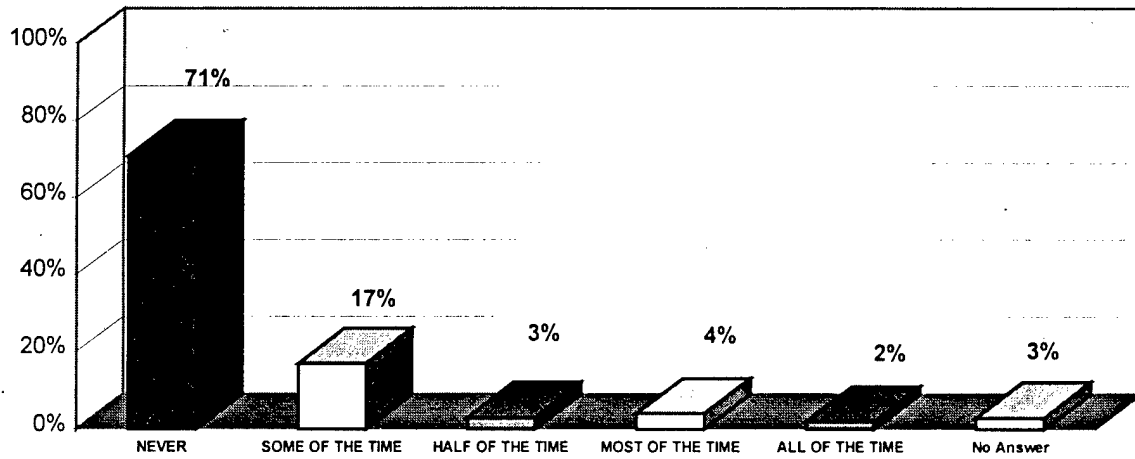


### 68D RESPONSES

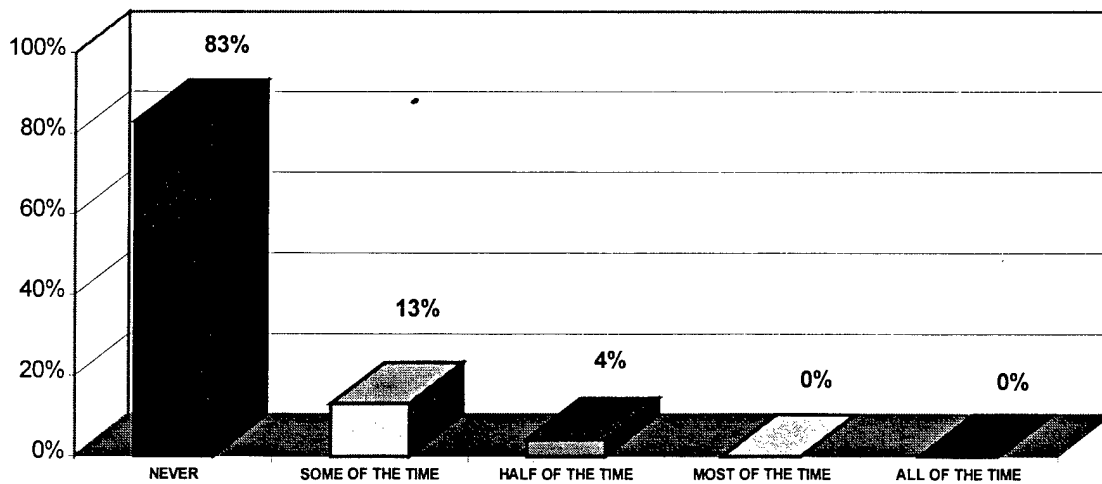


### INSPECTING AIRCRAFT COMPONENTS

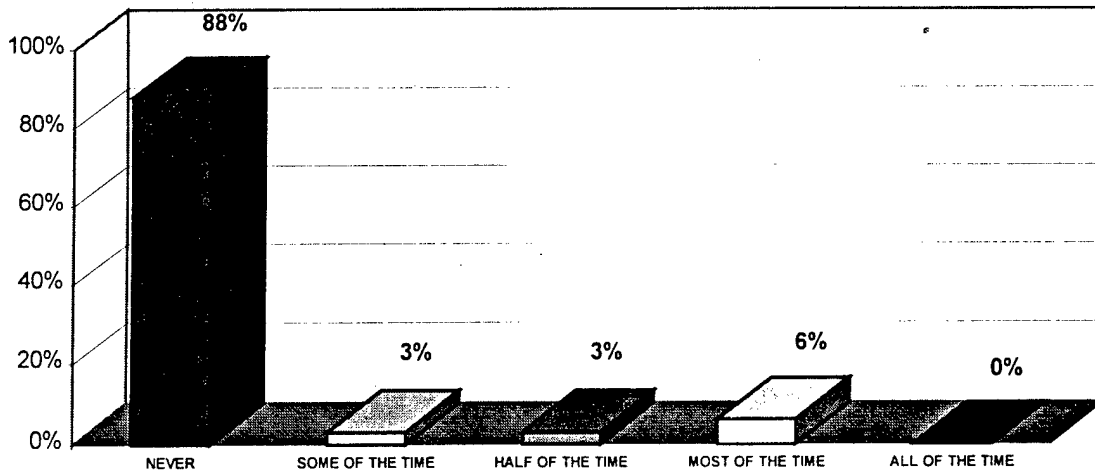
### 67R RESPONSES



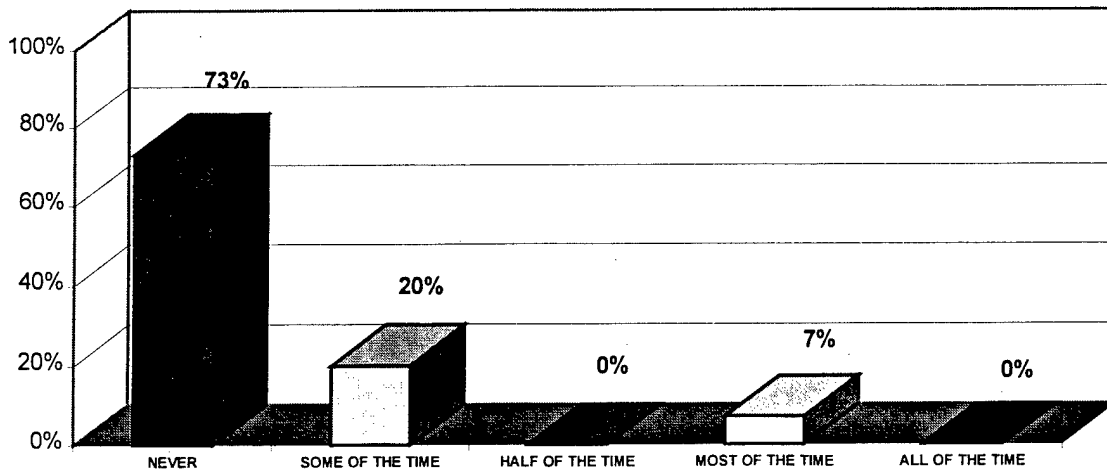
### 68X RESPONSES

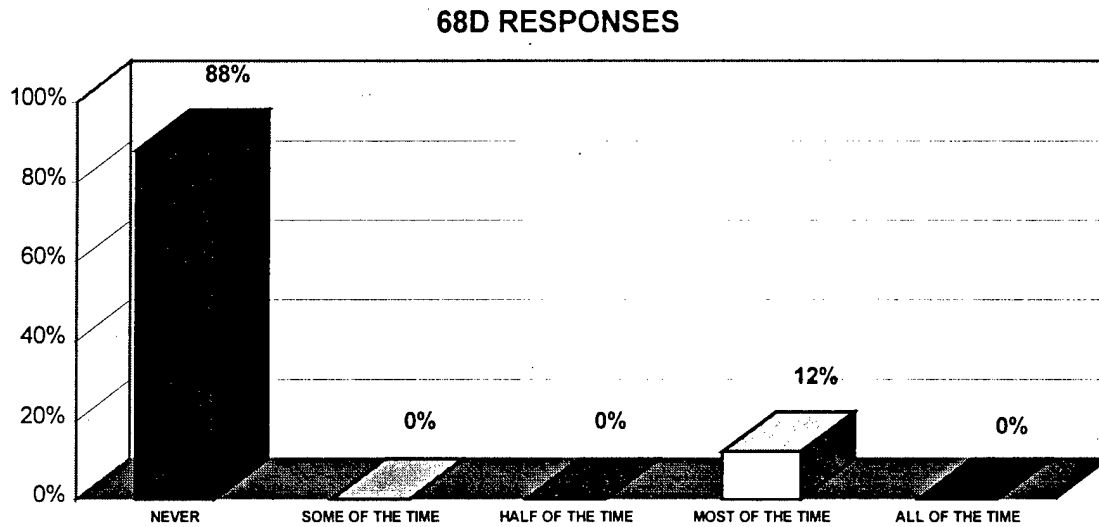


### 68N RESPONSES



### 68B RESPONSES





**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## 9.16 TOOL REQUIREMENTS

TR1. While performing the following tasks, list any tools you need that are not provided to you in your standard toolbox at AVUM?

### Troubleshooting Aircraft Components

#### 67R Comments

Multimeter-Ohmmeter: (7 Comments)

Multimeter. (6)

Ohmmeter. (1)

Socket and torque wrenches:(5 Comments)

Socket-torque wrench for grease plugs. (10

Socket-torque wrench for PC links. (1)

Socket-torque wrench for scissors. (1)

1 and 1/16 socket. (1)

1 and 5/16 socket. (1)

#### 68X Comments

Have too many tools. (6 Comments)

Most tools provided we do not need. (3)

Tools are good. Just too many to employ. (1)

We have too many tools in our box - 75% of them we don't even use (1)

Have too many tools. Can use the RATS. (1)

Multimeter. (5 Comments).

Multimeter. (5)

#### 68N Comments

No significant comments.



**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**Accessing Components**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## **Fastening and Unfastening Component Fasteners**

### **67R Components**

No significant comments.

### **68X Comments**

No significant comments.

### **68N Comments**

No significant comments.

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

## **Connecting and Disconnecting Component Connectors**

### **67R Comments**

No significant comments

### **68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**Lifting and Carrying Aircraft Components**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## **Removing and Replacing Aircraft Components**

### **67R Comments**

#### **Wrenches: (20 Comments)**

Torque wrenches. (9)  
Dogbone 7/16 inch. (3)  
Large wrenches. (2)  
Crowsfeet. (2)  
Dogbone 1/2 inch. (1)  
Dogbone 9/16 inch. (1)  
Dogbone. (1)  
Certain size wrenches. (1)

#### **Torque Adapters: (8 Comments).**

Torque adapters. (5)  
5/8 inch torque adapter for tail rotor gearbox. (1)  
9/16 inch torque adapter for tail rotor head. (1)  
Torque adapter for PTO clutch and tail rotor mounting bolts. (1)

### **68X Comments**

#### **3-8 Inch crowsfeet socket. (4 Comments).**

3/8 inch crowsfeet socket for the OAS. (4)

### **68N Comments**

No significant comments.

### **68B Comments**

#### **5/16 inch universal socket (4 Comments)**

5/16 inch universal socket (4)

**68D Comments**

No significant comments.

**Performing Operational Checks**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**Inspecting Components**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

## TEST EQUIPMENT REQUIREMENTS

TER1. While performing the following tasks, list any test equipment you need that is not provided to you at AVUM?

### TASKS

#### Troubleshooting Aircraft Components

##### 67R Comments

No significant comments.

##### 68X Comments

No significant comments.

##### 68N Comments

No significant comments.

##### 68B Comments

Multimeter: (3 comments)

Multimeter: (3)

##### 68D Comments

No significant comments.

## **Removing and Replacing Aircraft Components**

### **67R Comments**

No significant comments.

### **68X Comments**

No significant comments.

### **68N Comments**

No significant comments.

### **68B Comments**

No significant comments.

### **68D Comments**

No significant comments.

## **Performing Operational Checks**

### **67R Comments**

No significant comments.

### **68X Comments**

No significant comments.

### **68N Comments**

No significant comments.



**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

**Inspecting Components**

**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

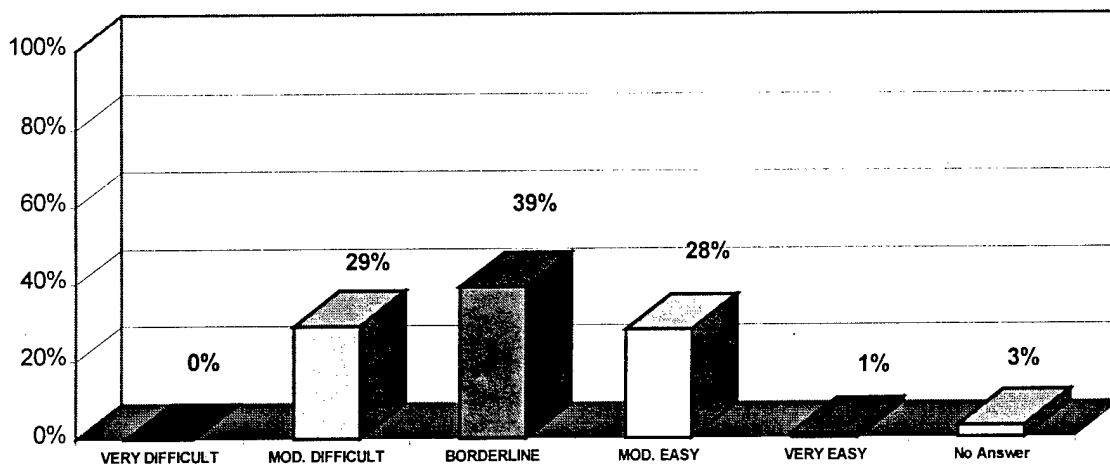
No significant comments.

## OVERALL DIFFICULTY OF MAINTENANCE

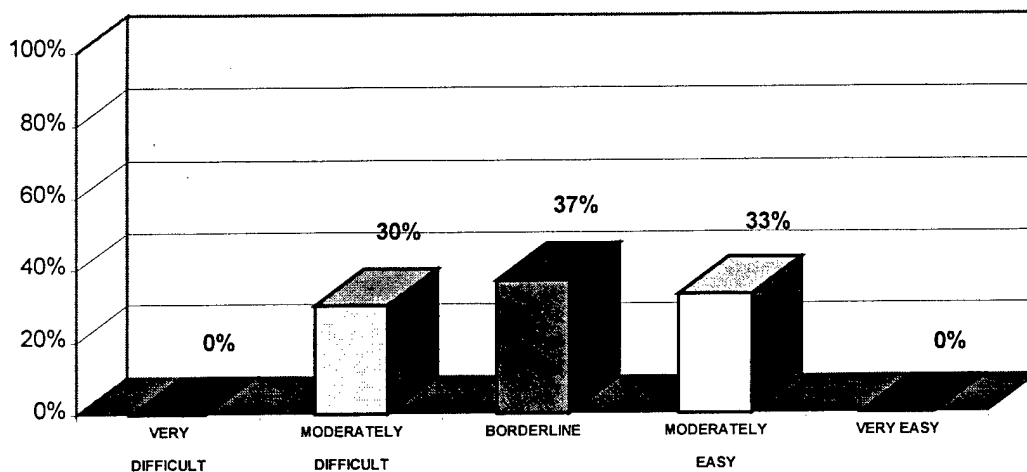
OM1. Overall, rate how easy or difficult it is to perform the following tasks on the AH-64.

### TROUBLESHOOTING AIRCRAFT COMPONENTS

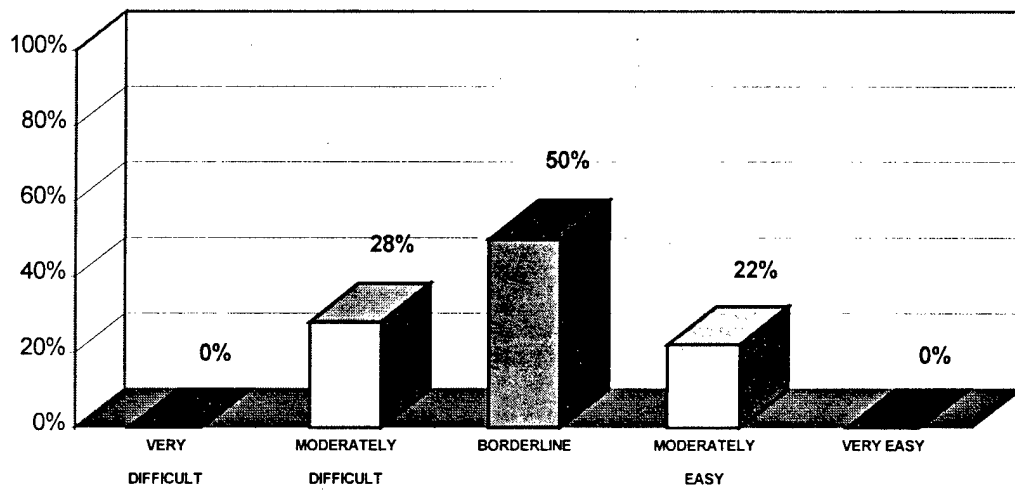
67R RESPONSES



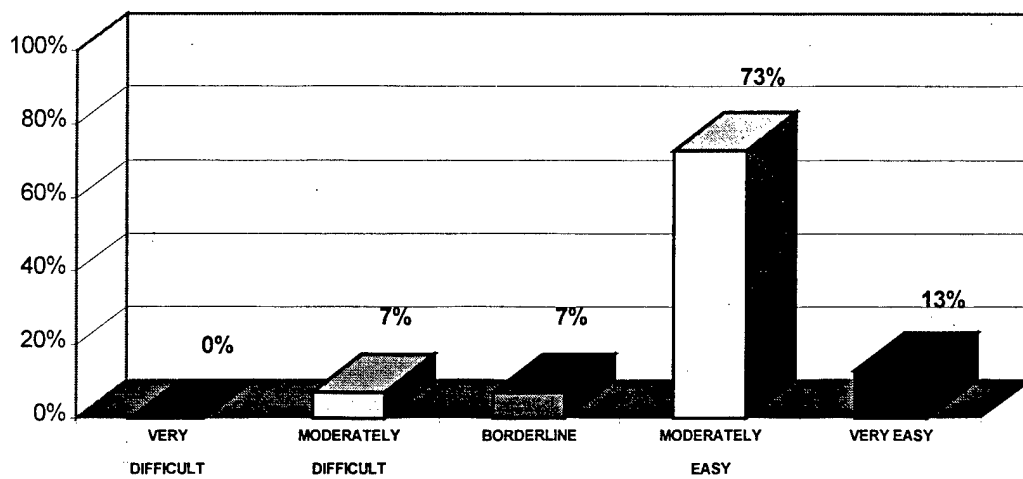
68X RESPONSES



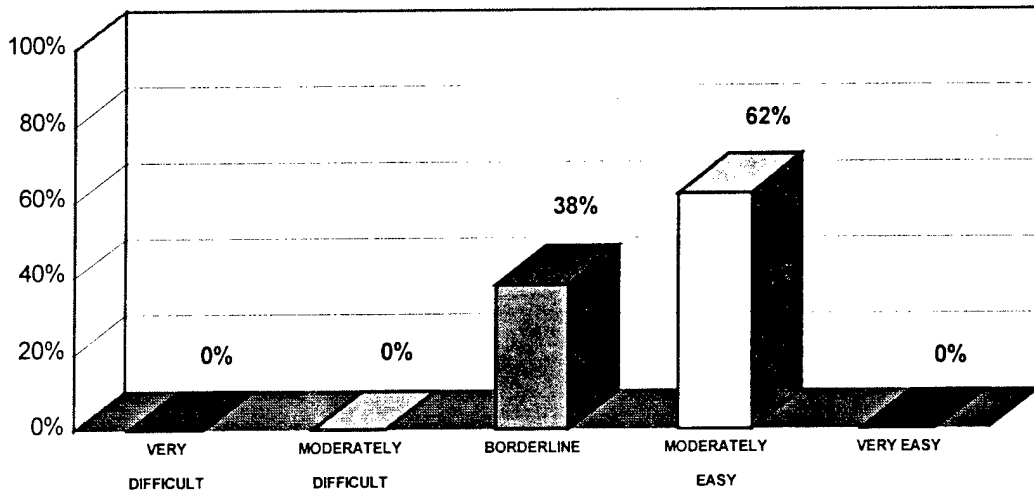
### 68N RESPONSES



### 68B RESPONSES

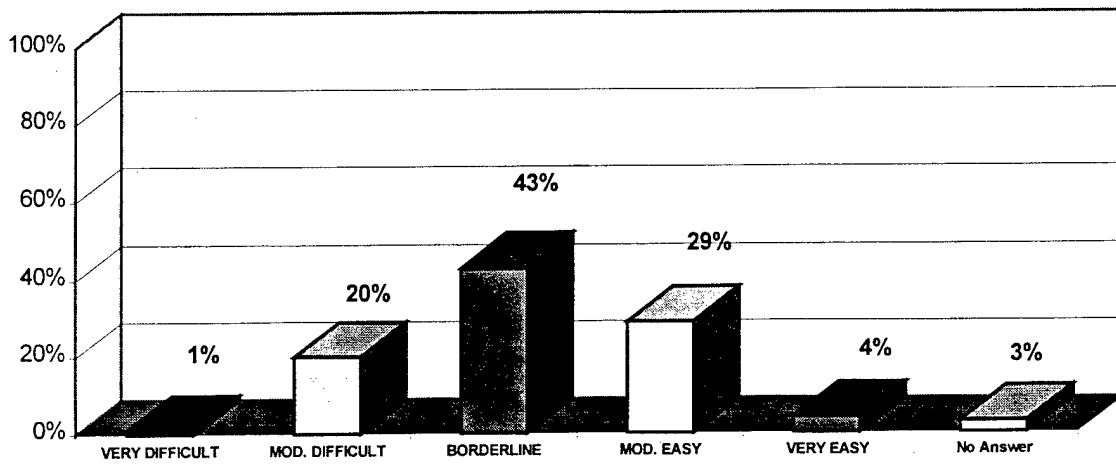


### 68D RESPONSES

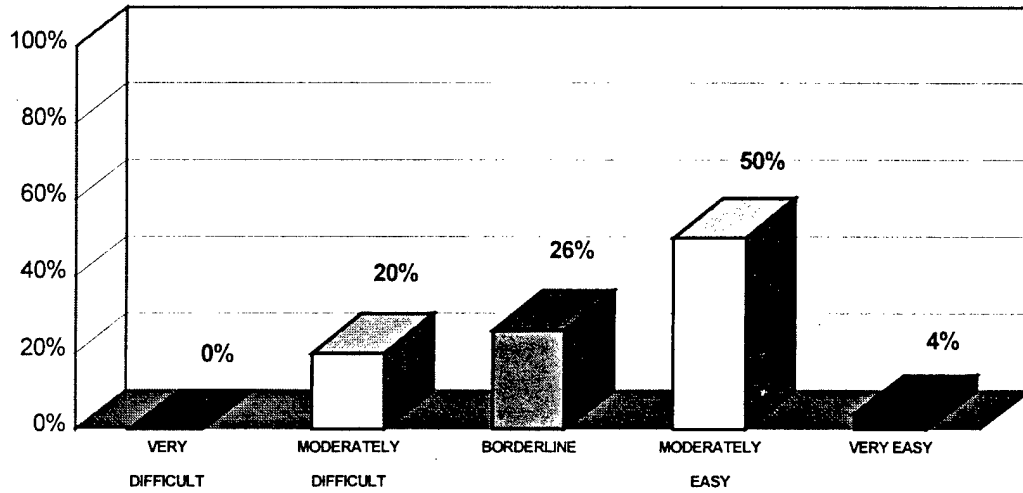


### ACCESSING AIRCRAFT COMPONENTS

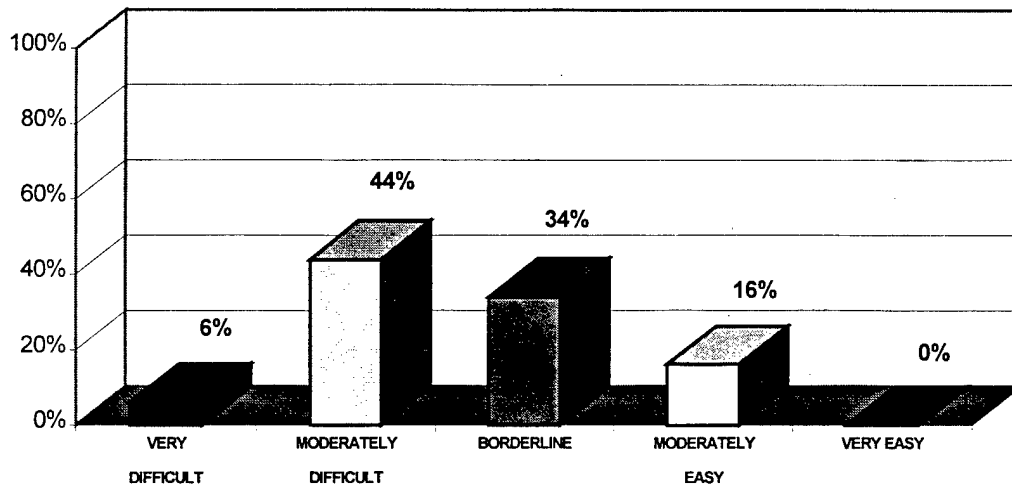
### 67R RESPONSES



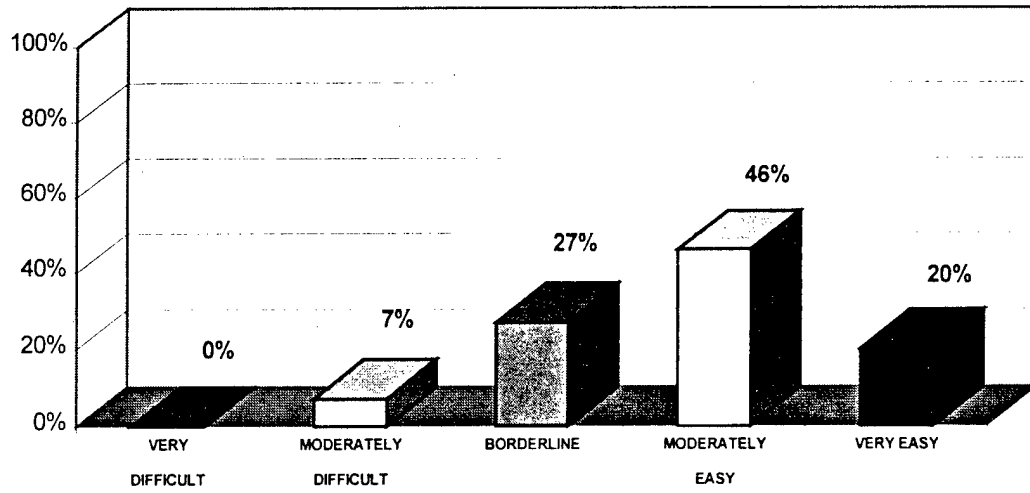
### 68X RESPONSES



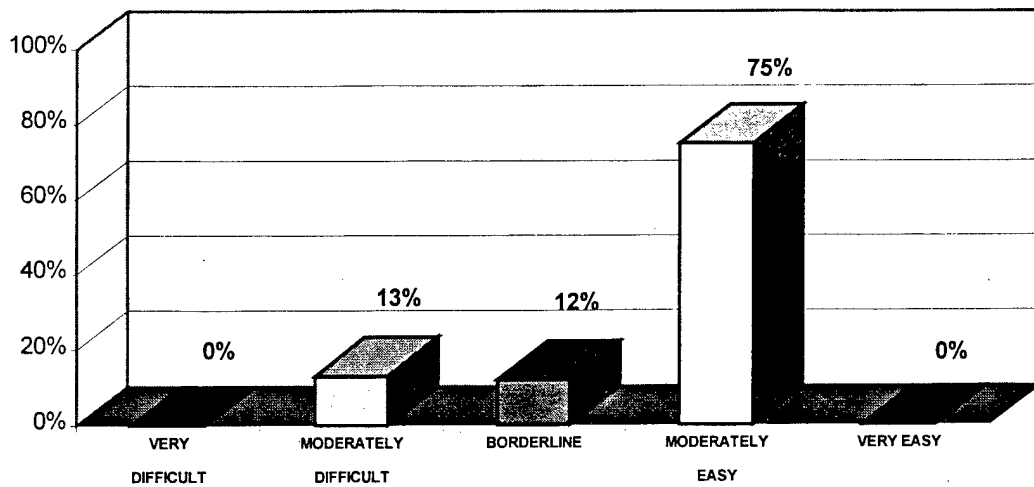
### 68N RESPONSES



68B RESPONSES

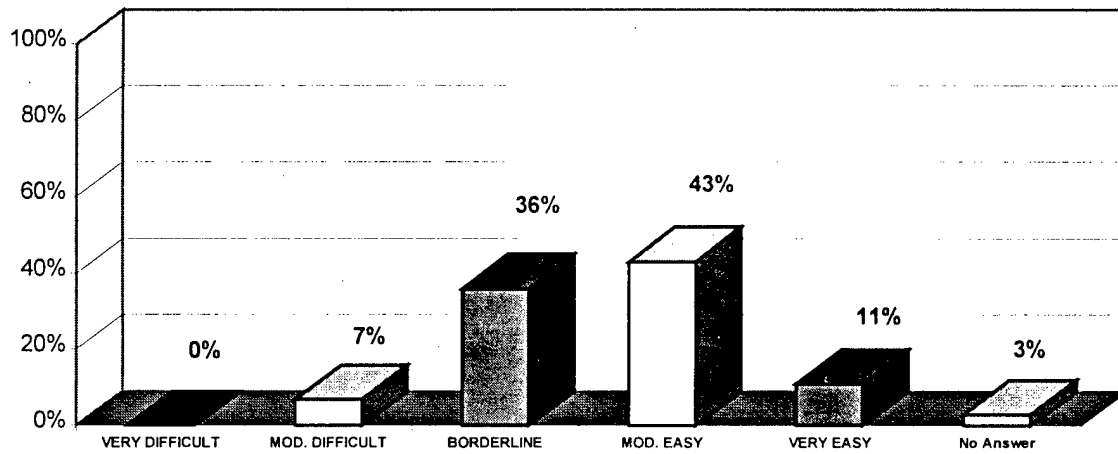


68D RESPONSES

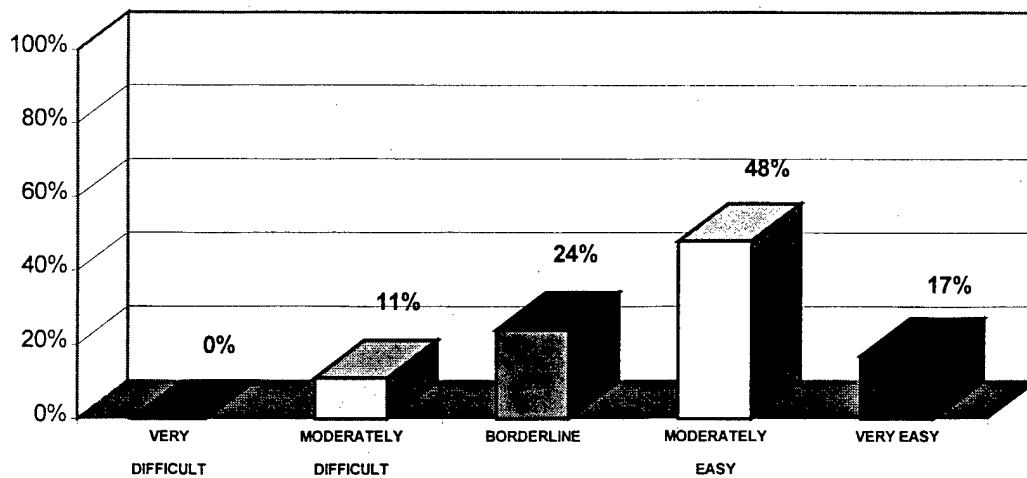


## FASTENING AND UNFASTENING COMPONENT CONNECTORS

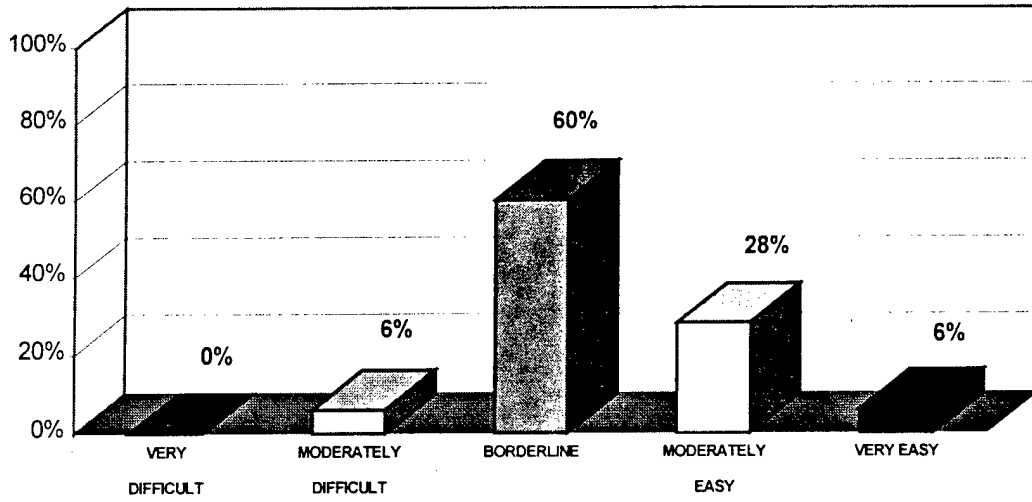
**67R RESPONSES**



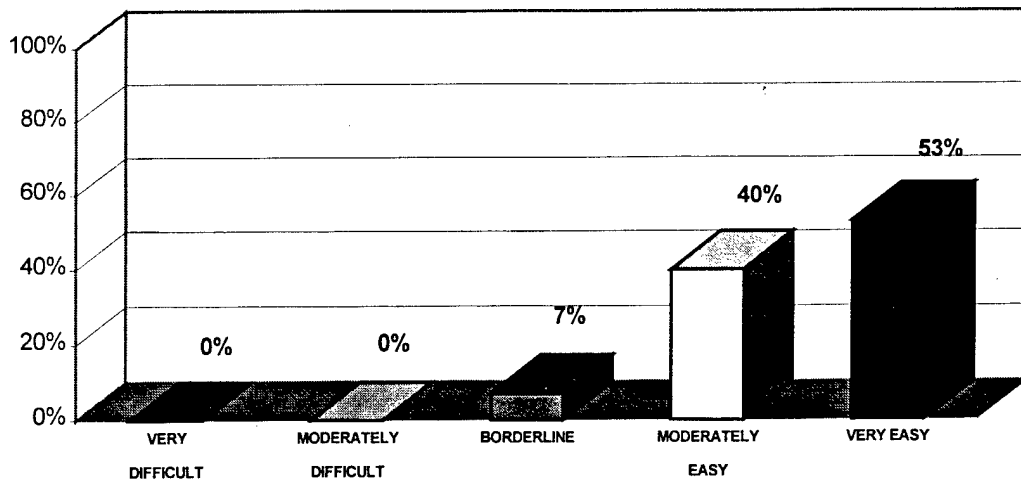
**68X RESPONSES**



**68N RESPONSES**

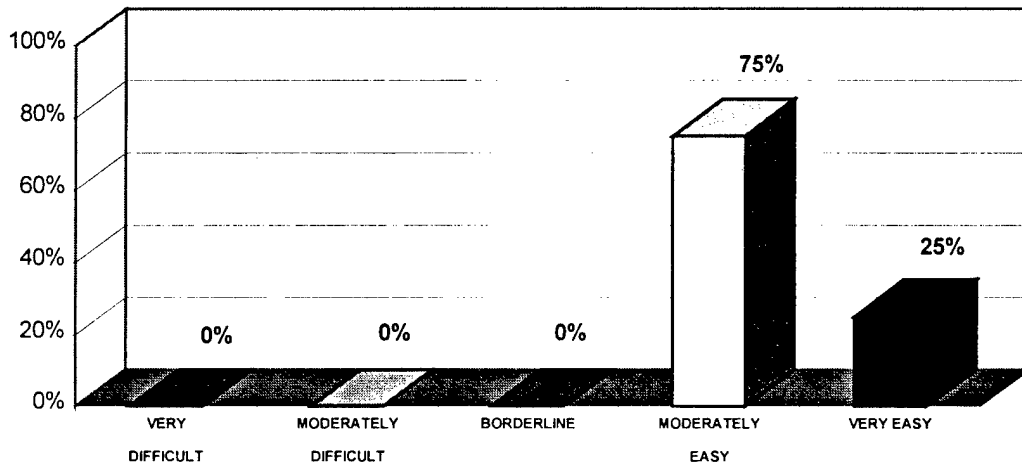


**68B RESPONSES**



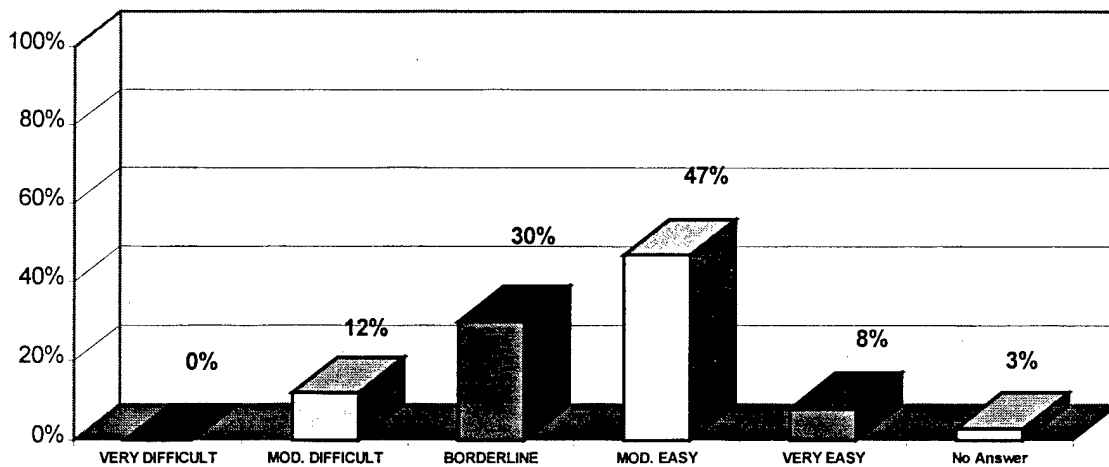


### 68D RESPONSES

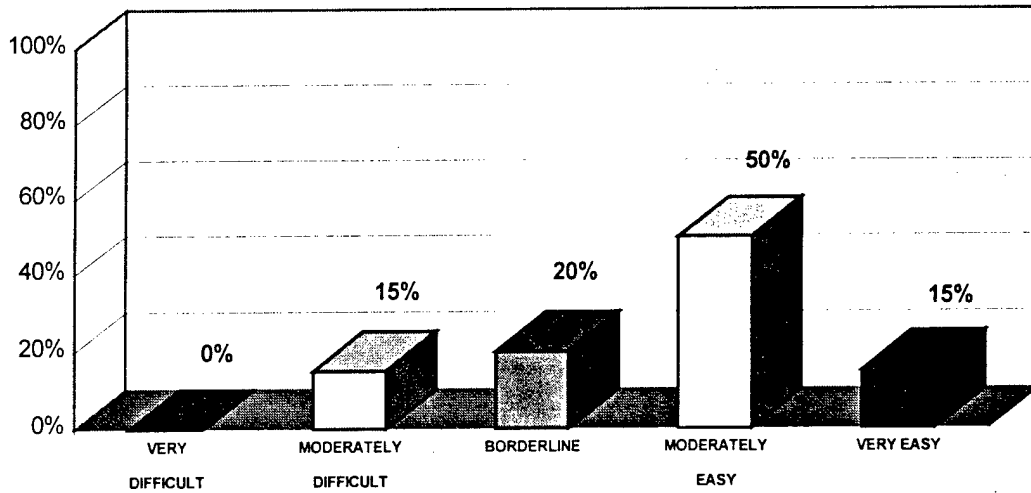


### CONNECTING AND DISCONNECTING COMPONENT CONNECTORS

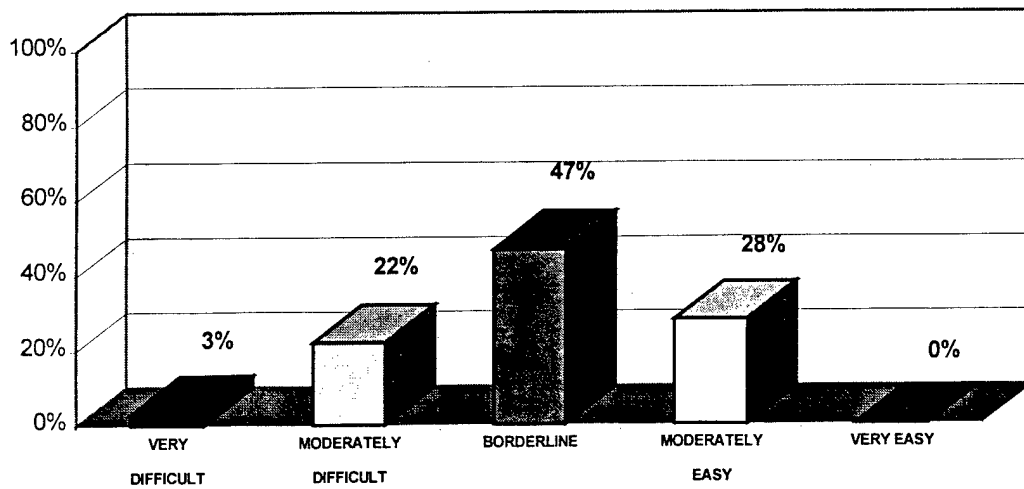
### 67R RESPONSES



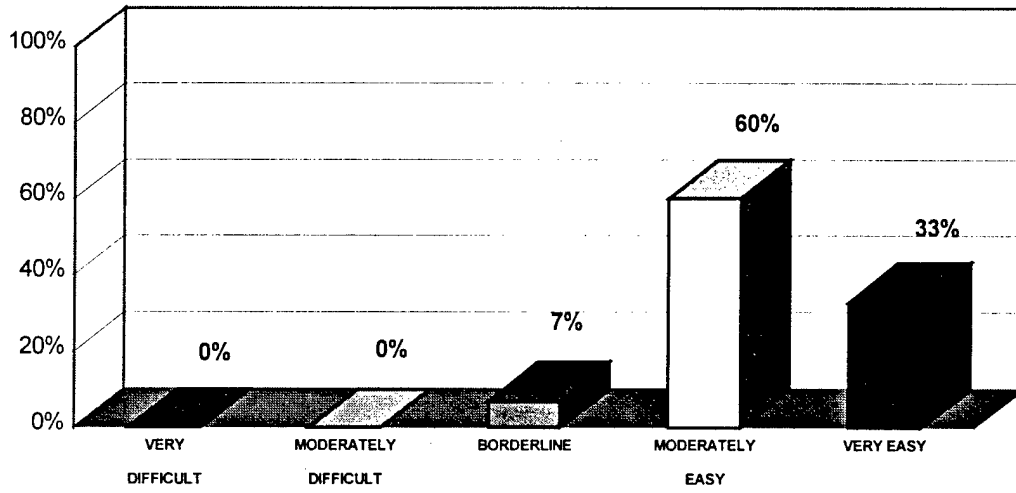
### 68X RESPONSES



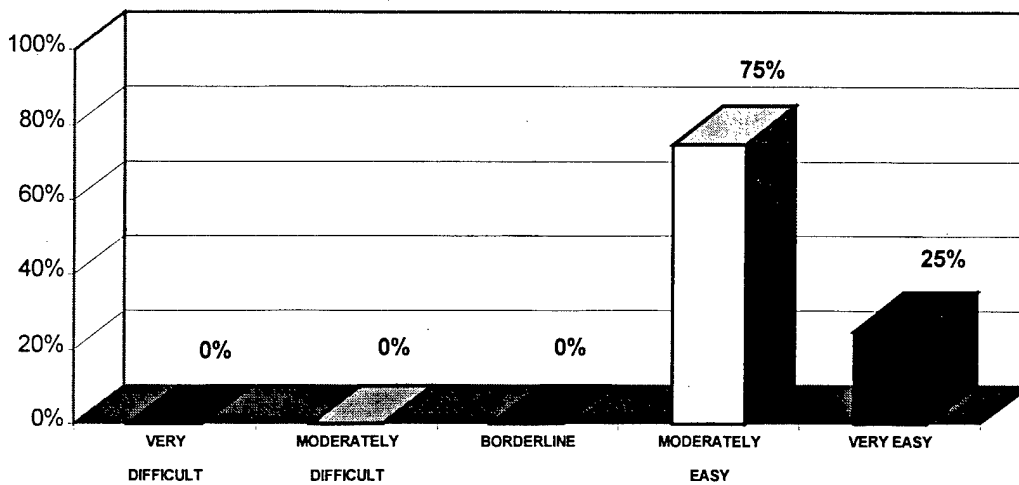
### 68N RESPONSES



### 68B RESPONSES

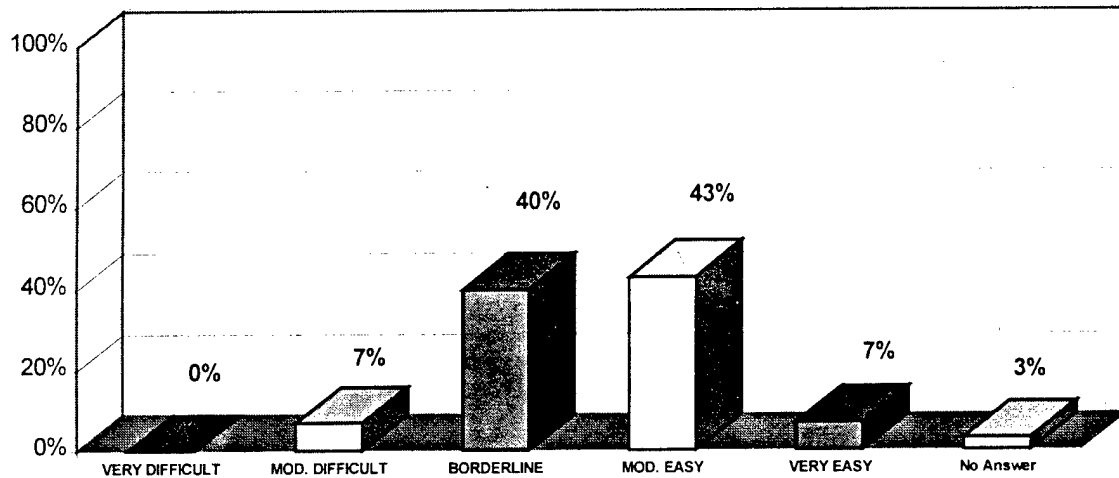


### 68D RESPONSES

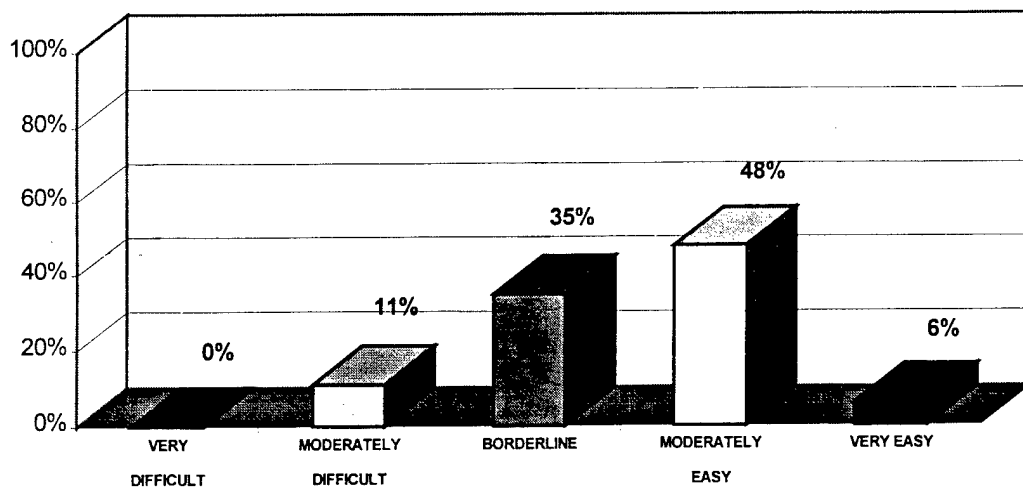


## LIFTING AND CARRYING COMPONENTS

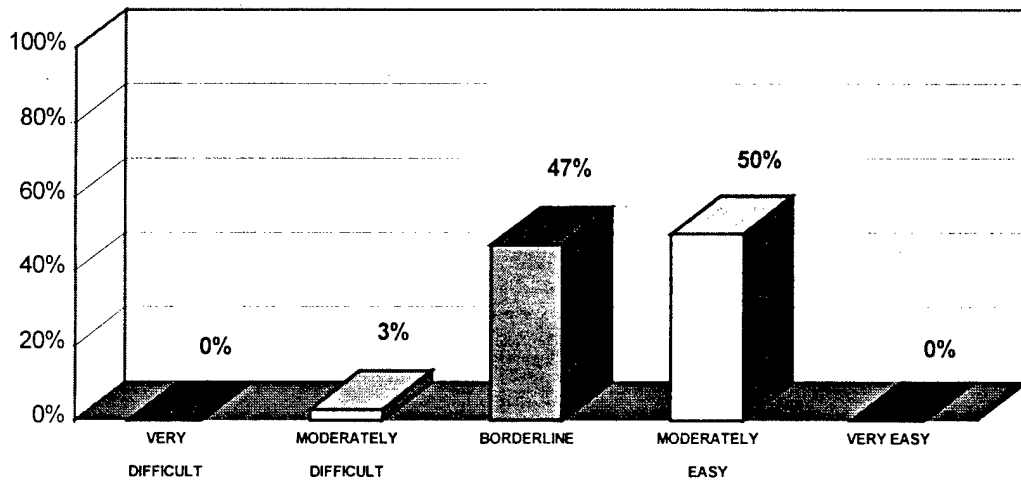
67R RESPONSES



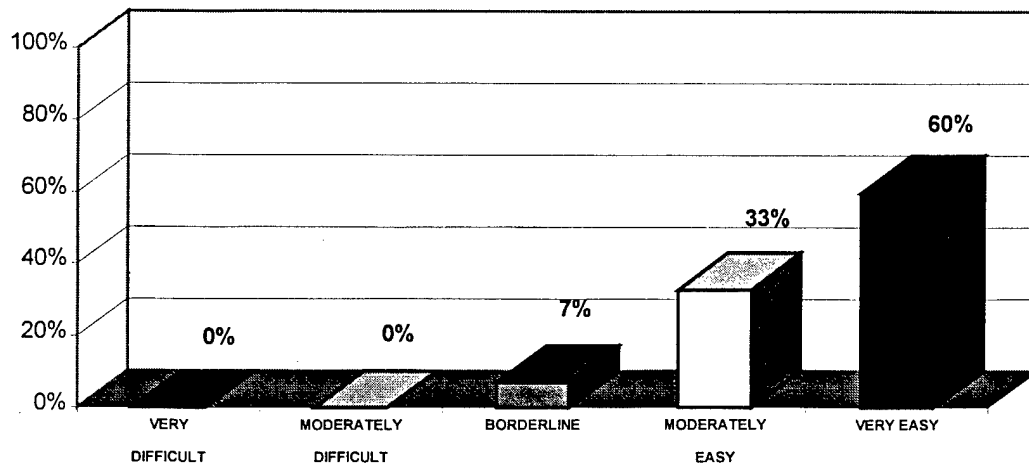
68X RESPONSES



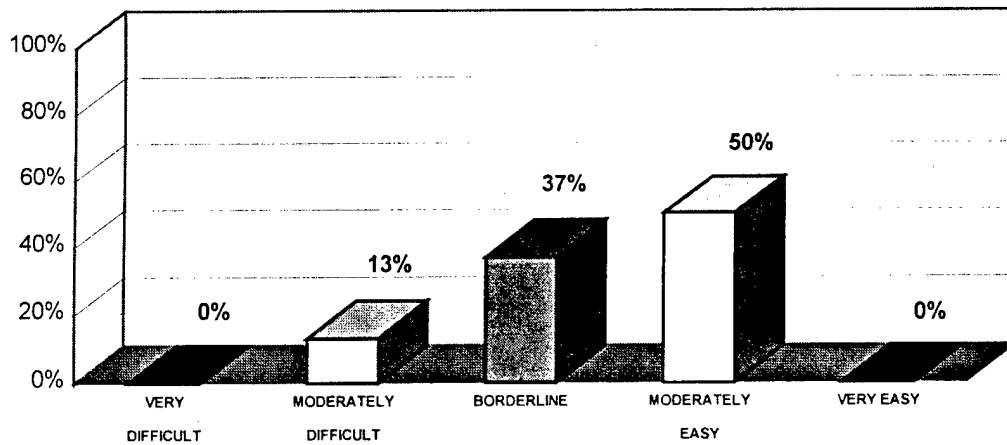
### 68N RESPONSES



### 68B RESPONSES

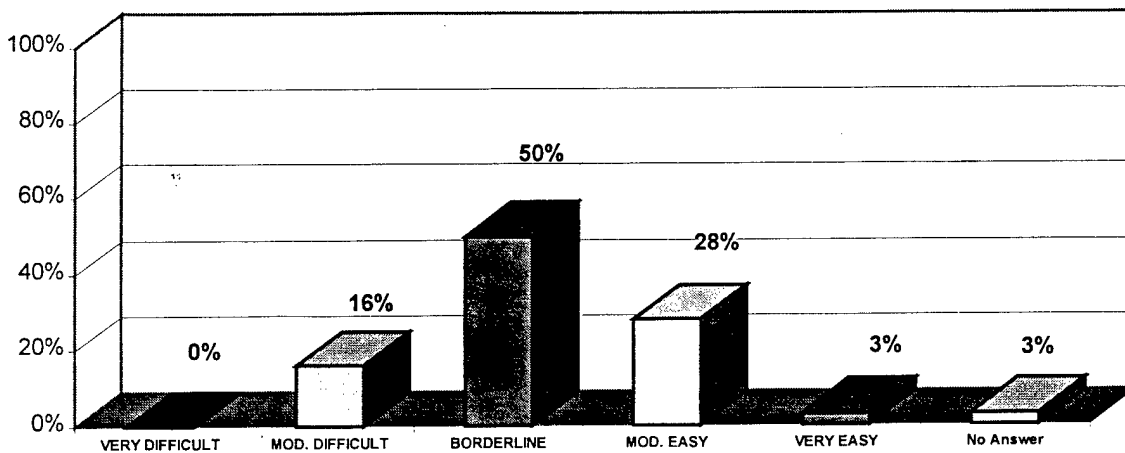


### 68D RESPONSES

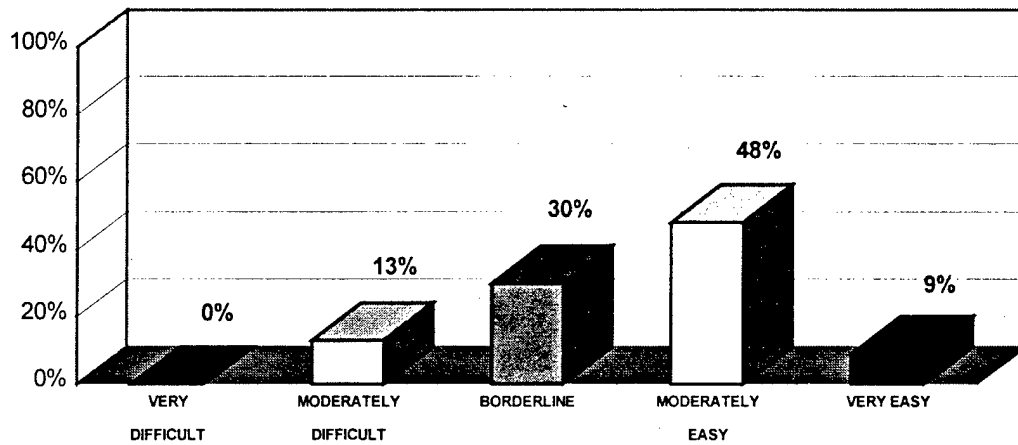


### REMOVAL AND REPLACEMENT OF AIRCRAFT COMPONENTS

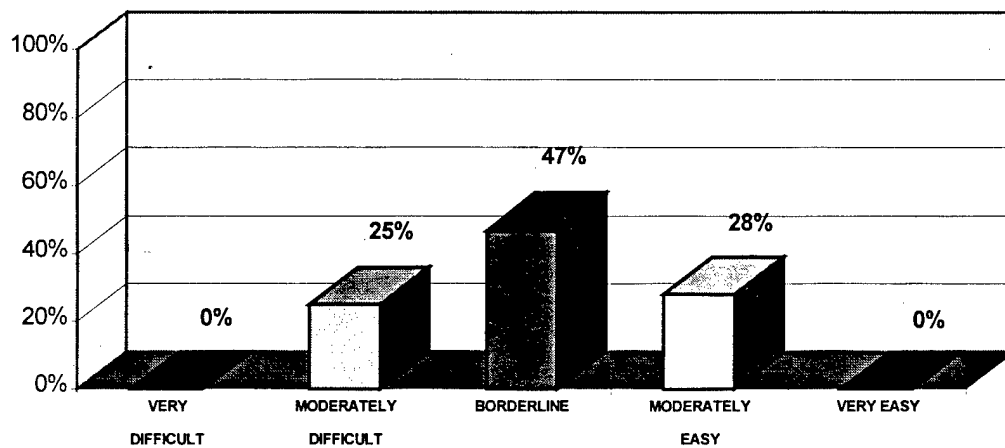
### 67R RESPONSES



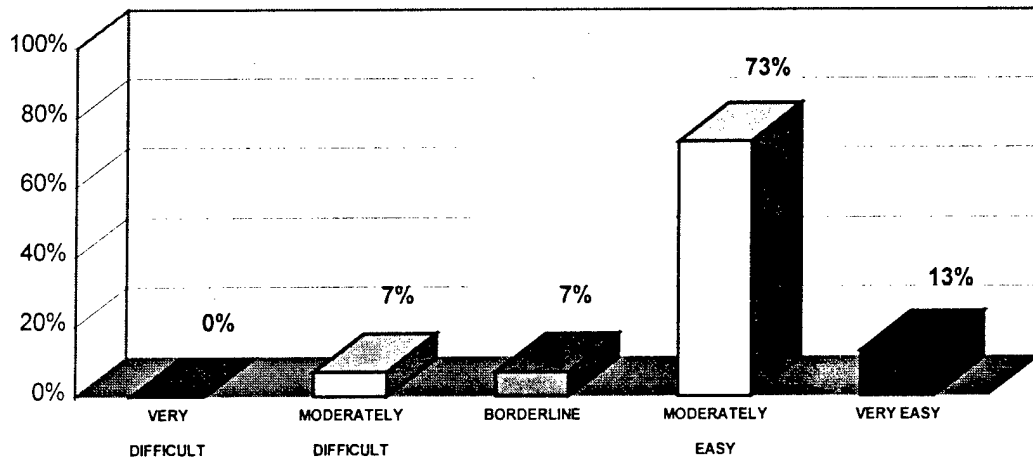
### 68X RESPONSES



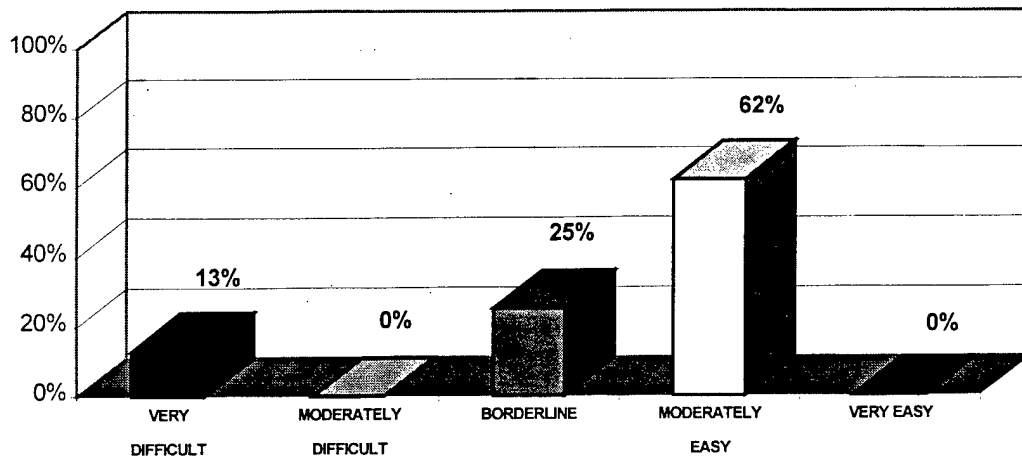
### 68N RESPONSES



### 68B RESPONSES



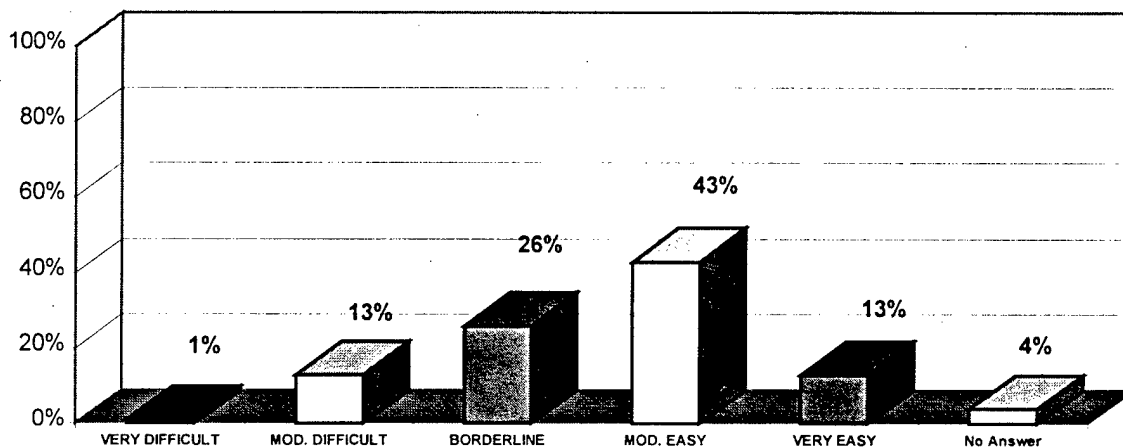
### 68D RESPONSES



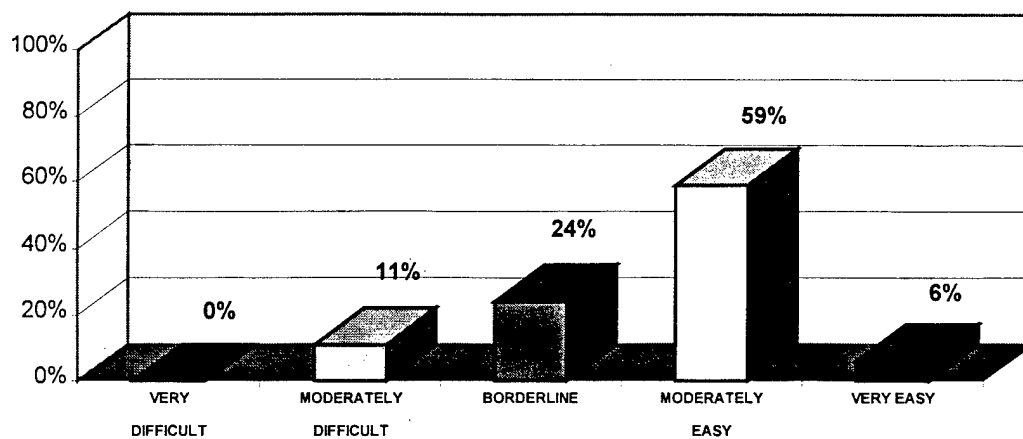


## PERFORMING OPERATIONAL CHECKS ON AIRCRAFT COMPONENTS

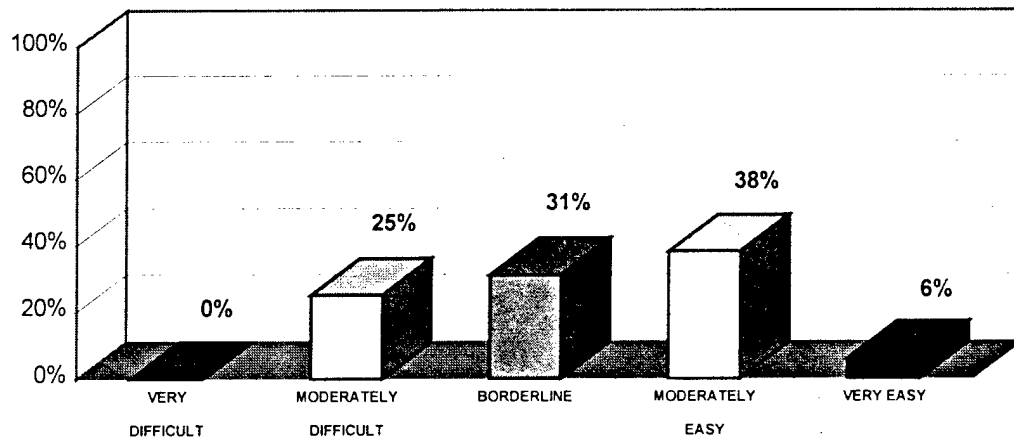
**67R RESPONSES**



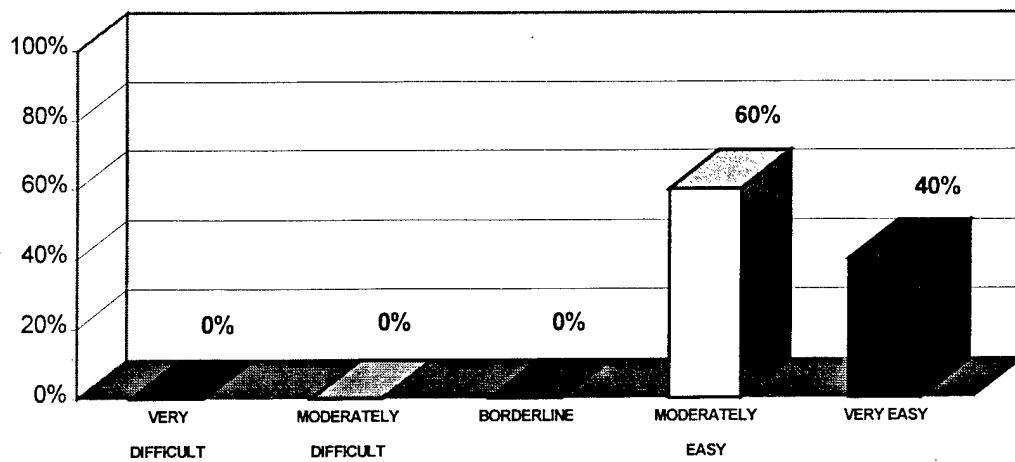
**68X RESPONSES**



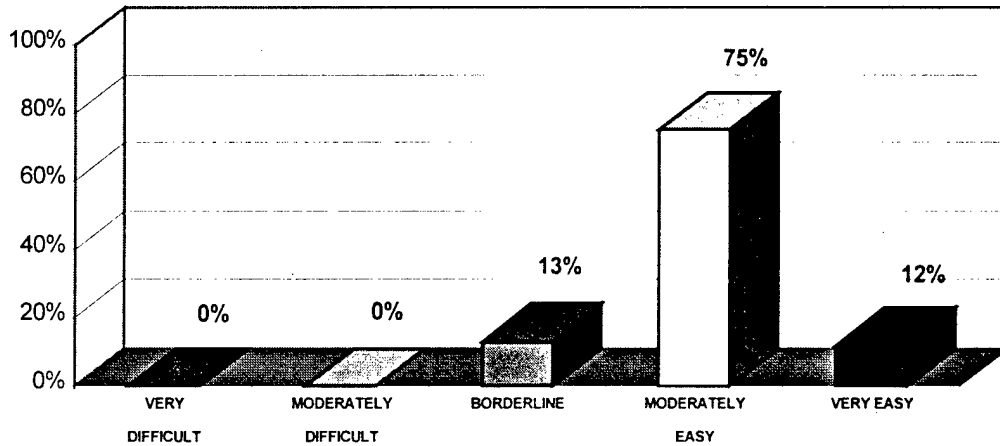
**68N RESPONSES**



**68B RESPONSES**

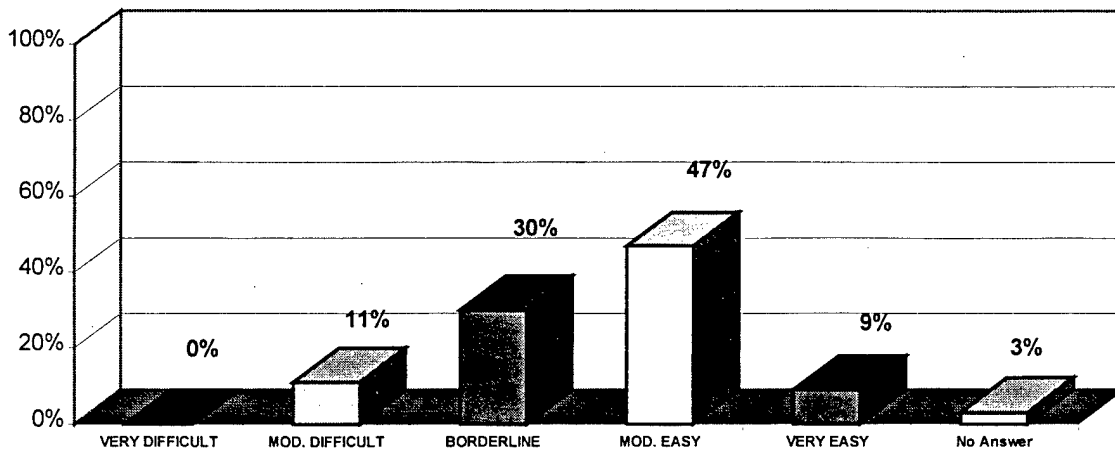


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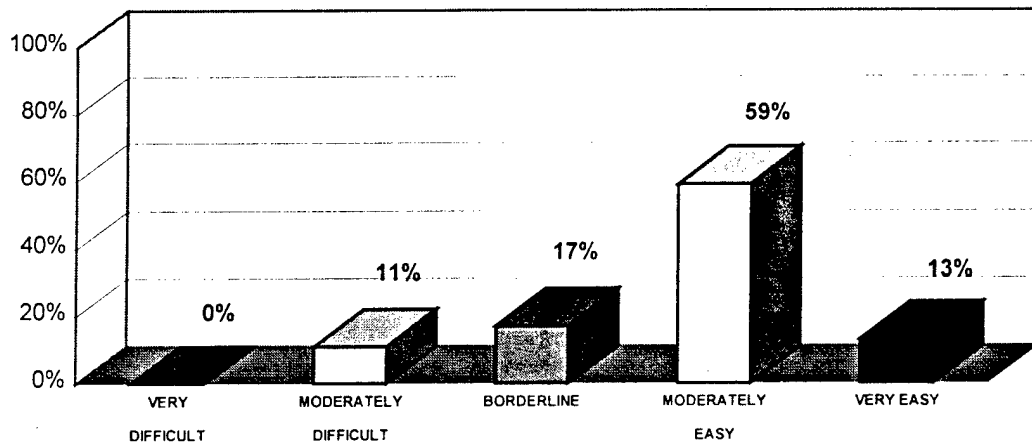


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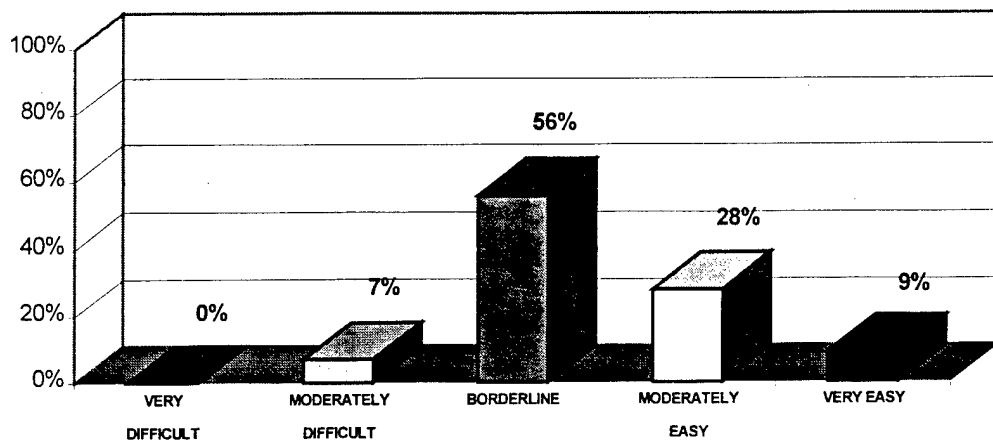
### 67R RESPONSES



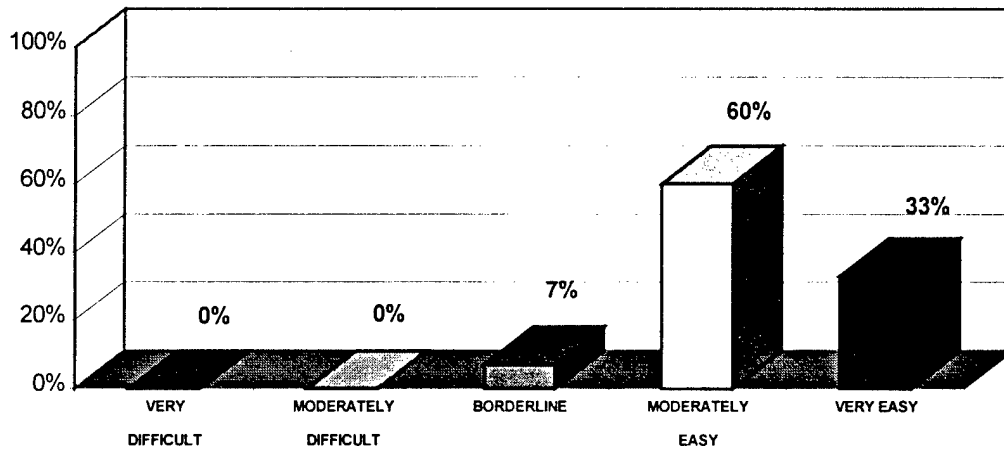
**68X RESPONSES**



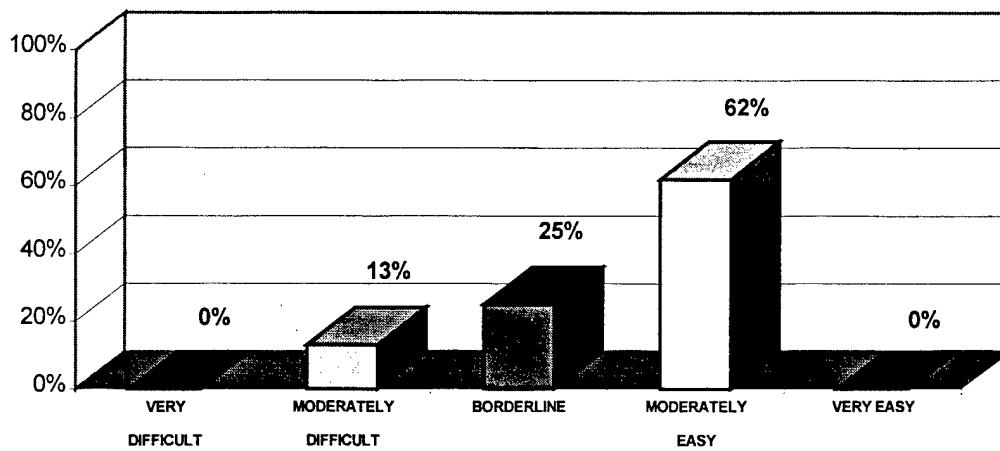
**68N RESPONSES**



### 68B RESPONSES



### 68D RESPONSES



**67R Comments**

No significant comments.

**68X Comments**

No significant comments.

**68N Comments**

No significant comments.

**68B Comments**

No significant comments.

**68D Comments**

No significant comments.

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ATTN AESE SA BUILDING 98  
AMC FAST SCIENCE ADVISER  
APO AE 09630

1 COMMANDER  
US ARMY PACIFIC  
AMC FAST SCIENCE ADVISER  
ATTN APSA  
FT SHAFTER HI 96858-5L00

1 COMMANDER  
US ARMY JAPAN/IX CORPS  
UNIT 45005 ATTN APAJ SA  
AMC FAST SCIENCE ADVISERS  
APO AP 96343-0054

1 AMC FAST SCIENCE ADVISERS  
PCS #303 BOX 45 CS-SO  
APO AP 96204-0045

1 COMMANDER ALASKAN COMMAND  
ATTN SCIENCE ADVISOR (MR GRILLS)  
6-900 9TH ST STE 110  
ELMENDORF AFB ALASKA 99506

1 ARL HRED ARDEC FIELD ELEMENT  
ATTN AMSRL HR MG (R SPINE)  
BUILDING 333  
PICATINNY ARSENAL NJ 07806-5000

1 ARL HRED ATCOM FIELD ELEMENT  
ATTN AMSRL HR MI (A MANCE)  
4300 GOODFELLOW BLVD  
BLDG 105 1ST FLOOR POST A-7  
ST LOUIS MO 63120-1798

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ATTN AMSRL HR MJ (D DURBIN)  
PO BOX 620716 BUILDING 514  
FT RUCKER AL 36362-0716

1 ARL HRED FT HOOD FIELD ELEMENT  
ATTN AMSRL HR MA (E SMOOTZ)  
HQ TEXCOM BLDG 91012 RM 134  
FT HOOD TX 76544-5065

1 USARL HRED FIELD ELEMENT  
USAADASCH  
ATTN ATSA CD  
ATTN AMSRL HR ME (K REYNOLDS)  
5800 CARTER ROAD  
FORT BLISS TX 79916-3802

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FT KNOX KY 40121-5215

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BLDG 3040 ROOM 220  
FORT SILL OK 73503-5600

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ATTN AMSRL HR MW (E REDDEN)  
BUILDING 4 ROOM 349  
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1 ARL HRED USASOC FIELD ELEMENT  
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HQ USASOC BLDG E2929  
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ATTN AMSRL HR MS (L BUCKALEW)  
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ELEMENT  
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BUILDING 84017  
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1	ARL HRED TACOM FIELD ELEMENT ATTN AMSRL HR MU (M SINGAPORE) BUILDING 200A 2ND FLOOR WARREN MI 48397-5000	1	LIBRARY ARL BUILDING 459 APG-AA
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